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New Impetus Given to Hydroelectric Development

THE action of the President in signing the bill authorizing the hydroelectric development of Muscle Shoals on the Tennessee River in Alabama should kindle anew the interest of the people of this country in their water powers. This site, which has remained unused until now because of government inaction, possesses potentialities exceeded only by Niagara. Time and time again have attempts been made to develop the powers of the Tennessee River at Muscle Shoals and to improve navigation, and it is only through the patience and perseverance of the business men of the South that success was finally achieved. The West and other sections of the country may therefore take heart and petition in season and out of season until their undeveloped water powers, too, are harnessed for the service of man. It is only by throwing on the spotlight of reason and argument that the profligate waste of power in our watercourses will cease.

The Sociological Problems Confronting Us

MANY constructive minds are now at work on the sociological and other problems arising from the labor situation in the electrical industry. The war has brought a great change upon us, and it is well that industry and society in general should take cognizance of it. It must be apparent that no real progress can be made without the elevation of the character of the whole people. The wildest of Bolshivists is no more harmful to the body politic than the reactionaries who, ignoring changed conditions, continue to play on passions which at length break out in the fire of revolution. The spirit of national service has cast into oblivion the idea of special privilege and class. Rather does it extend the hand of fellowship and of co-operation. The humanizing of industry is its chief function, and this carries with it the principle of joint industrial councils.

In all groups there are good and bad, in the moral sense. There are good lawyers and bad lawyers, good employers and bad employers, good engineers and bad engineers, good laborers and bad laborers. If the old clannishness of the professions does not disappear—and that quickly—the outlook is ominous. If all employers stick together as a class, the lawyers as a class, the industrial workers as a class, regardless of the good and evil among them, Heaven help us. But if the upsweeping protest against the poker players of all classes destroys clannish proclivities and aligns the good against the bad, then we are saved. The hope of salvation grows day by day. Our fight against a ruthless autocracy to which people are pawns has stirred our deepest age-old moral instincts.

Saving Public Utilities for War Service

BY RECOGNIZING the paramount needs of public utilities President Wilson places those properties under a deep obligation—not an obligation alone to him personally, but an obligation also to the public whose chosen leader he is, an obligation to the nation mobilized in the war for freedom of the world from German militarism. The President has no legal authority to compel state and local authorities to (in his words) "respond promptly to the necessities of the situation," but he has a moral authority greater to-day than that of any other man on earth. His correspondence with Secretary of the Treasury McAdoo, published in last week's issue of the ELECTRICAL WORLD, is a historic milepost in the public utilities industries. May it bear fruit!

Our readers are generally familiar with the course of the proceedings which culminated in the letter of President Wilson. The committee representing electric, electric railway and gas utilities found that its problems were not ignored by national officials. It was fully appreciated that these properties are vitally essential in the war, that their costs of operation have been advanced heavily, that their securities have suffered severely in the markets. Comptroller of the Currency Williams and Secretary McAdoo sense the facts. Both of them see clearly that the credit and earning power of these great properties must be sustained to protect the entire banking fabric. Mr. McAdoo tells the President that the data presented by the committee "indicate the existence of genuine apprehension regarding the adequacy under present conditions of the service and rates of local public utilities." Let there be no mistake on the part of any petty city or state official who mixes politics with true patriotism. "Our public service utilities are closely connected with and are an essential part of our preparations for the successful prosecution of the war," says Mr. McAdoo.

There will be no permanent lessening of the demand upon electric utilities for power. On top of the overwhelming need for war industries we now have a clear indication that the Fuel Administration may urge the closing of isolated plants and the substitution of central-station energy so that every possible pound of coal may be conserved. Upon the showing of the facts, the national administration is using its vast influence to safeguard the utilities. It remains for the state and

local authorities to make vital the recommendations of the President, to grant rate increases wherever they are justified. And if there is more sympathetic co-operation on the part of the regulating bodies in meeting serious requirements due to the war, the obligation upon the utilities to make their service all that it ought to be, to keep it from being anything that it ought not to be, will be strengthened. The need is urgent, the response should be prompt.

Motor Drive in a Shipyard

EQUIPPING shipbuilding plants just now is emphatically a hurry job, and the use of electric power for the various drives involved has proved greatly to facilitate installation, not to say operation. David Elwell's account of the electrical drives installed for the Staten Island Ship Building Company describes a capital example of the way in which intelligent engineering brings its reward in quick and certain operation. The case is unusually interesting because this new plant for steel vessels is on the site of a wooden shipbuilding yard already equipped with a 220-volt direct-current plant. As noted in a recent issue of the ELECTRICAL WORLD, it was found desirable with the new equipment to contract for alternating-current service, so that the problem of suitable selection of alternating-current motors came to the front. At the start-off the 220-volt direct-current plant was, to save time, utilized in the plate shop, the first building erected. Individual drive has been adopted throughout in this plant. The character of the machinery and the circumstances of its use made it undesirable to attempt group driving, as is very likely to be the case in operating heavy machinery.

A study was made of power requirements of the machinery based on the performance of the direct-current motors, and it was found, as is very generally the case, that most of the machines were equipped with motors unnecessarily large for the service. The data thus accumulated made it possible to make an intelligent choice of alternating-current motors for the purpose. Most of the machines start running light, and it was found that the standard squirrel-cage motors were entirely adequate for giving good service. In a few instances—particularly with the punching and shearing machines, which run idle and then deliver power almost instantaneously—another type had to be chosen. Machines of this class, to escape extremely high demand on the motor during the power stroke, are best fitted with flywheels, and the ordinary squirrel-cage motor fails to meet the necessities. For cases of this kind a squirrel-cage motor with high-resistance end connections was found to fill the bill excellently, giving sufficient starting and accelerating power without the complication of slip-rings. Only a few of the motors needed to be equipped with compensators, so that the whole motor plant is reduced to extremely simple terms.

At the voltage selected, 220, oil switches were unnecessary, and this again simplified the switching needs of the plant. In order to take the large starting currents required on the type of motor used the switches had to be heavily fused, but the character of the work is such that there is little chance for serious overloading of the individual motors belted to the machines in spite of the big fuses. The whole plant is wired in iron conduit, lighted by general illumination above the level of the crane, and affords an excellent example of emergency work quickly and skillfully done.

Saving Second-Hand Line Material

CONSIDERING the prices to which line material of every kind has risen within the last two or three years, the need of checking waste of every sort is obvious. A central station cannot afford to throw away or sell for a nominal figure anything which can be put to good use and will so save the cost of new material. A brief discussion of the situation by L. M. Klauber gives some very useful hints as to the ways in which second-hand line material can be effectively utilized. Some of these ways are altogether familiar, like cutting down and resetting poles. Others are not so universally practiced and deserve especial attention. Poles, of course, are the chief item of distribution-line renewals. The classification of old poles here made is a serviceable one. They are divided into three groups—those which can be replanted after the bases have been treated, those too short or light to be again used in the standard construction, and those so far gone as to have no value as carrying poles at all. With judicious inspection a good many poles can be reset on outlying lines or even where they are. Decay is usually at the ground line, and sawing them off above the line of decay and treating the new base, preferably by tank treatment, may very often make a pole capable still of a good many years' service.

Poles removed by reason of being too light for new conditions can still be used on outlying lines as poles for service lines and in similar ways. Those too light even for this service but in otherwise good condition can sometimes be utilized for telegraph and telephone construction in rural districts. Finally, the poles too far gone to cut down can find divers uses as guy stubs, braces, dead-men, and even fence posts, for all of which purposes they are worth more than mere waste wood.

Cross-arms present a tougher proposition. They may be in excellent condition, but are likely to be too short or too small to be easily put to use. Here again arms too light for electric light wires may be of value in building the extension of a country telephone line, for occasional house services, and for offset arms when too short for regular work. At the worst they may, like the stubs of poles, be utilized for rough construction work, and last of all for firewood, it being the common experience that discarded poles like discarded railway ties do not furnish convenient or high-grade fuel, although considerably better than nothing.

Old wire, which used to be almost universally sold for scrap, is now worth too much to put to such base use. If of the weatherproof kind, it is apt to be in bad shape before being taken down, but it can be skinned and as bare wire may serve a new term of usefulness. Old splices, of course, are overhauled and inspection made for kinks and weak spots. Short lengths make good tie wire in the smaller sizes, and in the larger sizes they are available for grounding neutrals and short connections of various kinds. Insulators are more troublesome than either wire or poles, unless they are of a size which can be worked in on secondary systems for services. Second-hand porcelain insulators, being

of a somewhat special kind, are less likely to be useful. To a certain extent the insulator pins and bolts taken down from a line may be utilized again readily if of standard size, but only at some little inconvenience if not of such size. And so one may go on.

Unipolar Induction Theory

THE December number of the *Physical Review* contains an article by Prof. George B. Pegram on "Unipolar Induction and Electron Theory." The article describes certain experiments on unipolar generator apparatus and analyzes the results obtained.

The first little unipolar direct-current generator was brought out by Faraday. Ever since that time the unipolar machine, or acyclic generator, has been recognized as a generator of continuous currents without needing a commutator. In recent years many such machines have been constructed in different types, although mostly in small sizes. There has been a perennial controversy carried on as to the correct way of explaining the action of some of them. A typical example consists of a cylindrical permanent bar magnet rotated by power about its axis and having two stationary brushes applied to its rotating surface. One of these brushes is placed, say, at or near the mid-length of the magnet. The other is applied near to one end of the magnet. These two brushes form the generator terminals and are connected by an external circuit in the usual way. A current is observed to flow in the circuit, say into the middle brush, through half the magnet and out from the end brush. The question agitated has been whether the emf. is generated in the substance of the rotating magnet, in spite of the fact that if the magnet carries its magnetic field around with it like a broom this field cannot cut the moving substance. Or is the emf. generated in the stationary part of the circuit external to the brushes?

The article pronounces in favor of the emf. being generated in the substance of the moving magnet. The reasoning is conducted in terms of the electron theory, but it may of course be presented in other terms. The emf. generated in an element of a conducting circuit may be produced either by a real rate of change in the vector potential at that point or by the transverse motion of the element with respect to a magnetic field. It is not necessary in the latter case that the field should be stationary. The field may or may not be in motion. If the conducting element moves, an emf. will be generated therein by the field. According to this deduction, a bar magnet generates an emf. in its own substance when it rotates. It is not an essential question whether the field rotates with the magnet or not. The only essential fact is that elements of conductor are moving, and they are also permeated by a transverse magnetic field.

Business Men Indorse Daylight Saving

A PRESS bulletin issued by the Chamber of Commerce of the United States brings once more before the public eye the question of daylight saving which is provided for in the Calder bill now before committee. We have several times taken up this subject and have adhered consistently to the opinion that it is an interesting and probably useful program, not likely to produce any notable results on the prosperity of the lighting industry, and to which the only material objections are the possible inconveniences that would be felt at certain places owing to the division of the country into time belts each extending over a considerable range in latitude.

The results obtained last year abroad were very various, according to the reports from different regions, but on the whole there is general agreement that the plan worked out very well and did not involve material inconveniences. The actual saving in fuel which may be obtained cannot safely be predicted since much depends on the completeness with which the general habits of the people adjust themselves to a new clock time. It will be hard in fact to estimate the real results even after a year's trial, since they will vary from city to country and will be profoundly influenced by the increasing amount of work in three shifts which is now going on in war industries and which obviously will not be materially affected one way or the other by the change. In certain communities one of the advantages pointed out in the bulletin will prove to be of considerable importance for a portion of the period involved; that is, the separation of the transportation and lighting peaks, which are now commonly nearly coincident.

The experiment is well worth trying for the sake of uniformity and on the strength of foreign experience, if for no better reasons. There do not seem to be any substantial arguments against it, since trials elsewhere have failed to develop any. If Congress thinks it wise to inaugurate the change, we trust that it will act promptly enough to have the experiment begin by the middle of April, and not allow the proposition, as last year, to drag on until really too late for action.

The Coming Issues

SHORTAGE of coal and the fact that fuel represents a very large portion of the total operating expense of central stations demand that every possible method of increasing the efficiency of energy utilization be tried. Prevention of heat radiation from boiler and engine room equipment is one such means. In an early issue the magnitude of heat losses due to radiation from pipes, fittings, etc., the characteristics required in heat insulation, the thickness necessary for modern power-plant pressures and superheats, and the value of insulation as an investment, will be discussed. Bearing on the general problem occasioned by slow deliveries of equipment and the consequent difficulty of meeting service demands, two articles will shortly be presented—one pointing out how larger outputs can be obtained from generators already installed by precooling the air, the other dwelling on how installations of self-cooled transformers can be made to carry larger loads through simple changes that permit circulating the oil. Data are given in each case to show the effectiveness of these methods. For engineers who hesitate about using formulas involving hyperbolic functions in making transmission-line calculations an early issue will reproduce charts which permit obtaining all the line constants graphically so that complex calculations are avoided and the effect of different conditions on their constants can be easily studied.

Coal Supply Made Sure by Buying Mines

Forehanded Policy by Which Commonwealth Edison Company of Chicago Made Large Purchases of Coal Mines and Land to Protect Its Supply of Fuel and Safeguard Against Ever-Increasing Cost

This article gives the reasons why the Commonwealth Edison Company of Chicago began fourteen years ago to buy coal mines and lands. The costly experiences of the last year have led a number of other central-station properties to purchase, or to inquire into the advisability of purchasing, similar properties.

ADEQUATE coal supply at reasonable cost is the keystone of successful operation by electric utilities with steam generating plants; without it these properties cannot profitably furnish service. The companies may have capital investment whittled to a minimum, with fair rates, economical operating methods and happy public relations, but unless they have in addition an assured steady supply of fuel at a price which they can afford to pay they face serious fetters upon their economic welfare.

LESSONS OF TWO WINTERS

The last two winters brought dismay to many central-station companies relying upon steam-generated energy for their service to their communities. They were not fully prepared for revolutionary changes in the coal industry. Trying to follow the established policy of buying coal as cheaply as they could and maintaining as good a reserve as possible against exigencies, the great bulk of the companies got caught in 1916-1917 in the war-time vise of short supply, runaway demand and sky-rocketing prices. To keep generating plants going they paid exorbitant figures for fuel. They invoked the favor of coal producers and suppliers, the efficiency of transportation agencies, the power of city authorities. And they came through the winter of 1916-1917 without general service interruptions, though the margin in many cases was a very tender one. The record of the winter of 1917-1918 was less satisfactory.

Distressing experiences carry a twofold lesson which, notwithstanding all other trials and problems of the times, is impressed deeply upon the executives and managers of central-station properties:

First, the stirring necessity of providing amply in advance for the coal requirements of the winter.

Second, looking ahead to future years when the scrambling will be over and coal conditions are again more normal, it is realized that in all probability permanent changes in coal cost will have to be faced.

With the two aspects of this situation the ELECTRICAL WORLD has dealt in frequent articles and editorials during the last year; the longer outlook is presented in this article, describing methods adopted by certain companies which not only strengthen and protect their present position but farsightedly safeguard their coal supply for the future.

The first large electric utility to take positive steps to assure its future coal supply at reasonable cost through the purchase of coal-producing properties was the Commonwealth Edison Company, Chicago. Its action in so doing is the more conspicuous because it is not a policy brought about by recent serious developments; it was conceived and inaugurated, after a careful survey of conditions and the outlook for the future, as early as 1904.

It was on the personal initiative of Samuel Insull, the president, that the Commonwealth Edison Company began to purchase coal lands about thirteen years ago. Mr. Insull decided to follow this policy as a result of study of several considerations. One of these was that the entire coal business was then in a state of demoralization. This demoralization lasted for a number of years following the initial purchases of coal lands to protect the supply of the Commonwealth company, but Mr. Insull felt confident that it would not continue permanently. At the time when the foundation policy was laid down, much coal was being sold in Chicago at less than the fair cost of production. It was believed that continued operation of the central-station company at a cost which included fuel at less than the fair cost of production was a dangerous basis for a public utility. Under these conditions the company would be selling its product of energy at unjustifiably low rates. It was reasoned that at some future time the coal industry would reach a more stable basis and that thereafter coal would be permanently higher. Any company selling energy at abnormally low rates because it was benefiting by demoralization in the industry from which it obtained a large part of its raw materials would have to confront, when the demoralization was overcome, the necessity of increasing rates to consumers.

Another consideration which influenced Mr. Insull to take action was that Illinois coal lands, as compared with similar property in other sections of the country, were cheap. Some of the early purchases, for instance, were made at prices as low as $15 an acre. Besides being an operating safeguard, it was confidently believed that the purchase of coal lands would therefore be an excellent investment from a financial standpoint. This judgment has been borne out by the course of events. In 1913 and 1914 the lands had enhanced in value to about $50 an acre, while at present, under the stimulus of the extraordinary war conditions, they are rated as worth $75 an acre.

SAFEGUARDING THE FUTURE

In addition to these considerations was the vital one of raising safeguards for the coal supply for the future. Controlling enough lands to assure a source of supply without regard to what other producers did, the company could be more independent of general conditions in the coal market. As a matter of fact, it is estimated that the Commonwealth Edison Company owns enough coal lands to provide for its supply for a hundred years.

Following the same general policy, newer organizations under the direction of Mr. Insull and his associates—the Middle West Utilities Company and the Pub-

lic Service Company of Northern Illinois—have also acquired interests in operating coal properties.

The main coal-land holdings of the Commonwealth Edison Company aggregate about 45,000 acres of land, after deduction of the acreage already mined. The nucleus of this large holding was acquired on April 1, 1904, by the Illinois Midland Coal Company, controlled by the Commonwealth interests and the Peabody Coal Company. These companies had equal shares in the coal property. The Chicago & Illinois Midland Railroad was also acquired. This line is operated between Taylorville and Auburn, Ill., and connects with four roads reaching Chicago—the Illinois Central, the Chicago & Northwestern, the Chicago & Alton and the Wabash.

EXTENDING THE INVESTMENT IN COAL LANDS

Some years after the initial investment was made it seemed advisable to the Chicago company to purchase one-half of the coal lands owned by the Peabody Coal Company, and this was done. By that time the coal lands had appreciated materially in value, but not to so great an extent as they have done under the later stress of war conditions. In connection with this transaction the Midland Counties Coal Company was formed to take over the properties.

The main holdings of the Midland Counties Coal Company are at Kincaid, Christian County, Ill., and aggregate 40,000 acres. This company has also a mine at Pawnee, Sangamon County, Ill., and another at Sherman, near Springfield, the capital of Illinois. It has, in addition, 1300 acres of coal land in Vigo County, Ind., which have not been developed.

In the extension of the policy of buying coal lands to other Insull properties some mining lands were acquired on a co-operative plan. Last year the Midland Counties Coal Company (the Commonwealth subsidiary) and the Public Service Company of Northern Illinois acquired coal rights in 600 acres of land near Shelburne, Sullivan County, Ind. There was also bought for the Public Service Company 600 acres near Johnson City, Williamson County, Ill. In each of these purchases the Middle West Utilities Company bought an interest of 15 per cent. Ownership of the Indiana mine rests in the Indiana Hocking Coal Company. The mine in Williamson County, Ill., is owned by the subsidiary Big Muddy Fuel Company.

All of these mines are operated by the Peabody Coal Company of Chicago. The contract covering the large Midland Counties properties is for a period of twenty-five years. The output of these mines at present is about 2,000,000 tons per year. It has been increased gradually to this figure. When first acquired only two mines were in operation on the property. In 1912 the work of opening No. 7 mine at Kincaid was started. This construction, which equipped the mine to hoist 4000 tons daily, was finished in 1913, and in that year the company began to sink another shaft. This mine, called No. 8, has also capacity to hoist 4000 tons daily. These two mines are among the most modern in equipment in the country.

As the two original mines had capacity to hoist 2200 tons each daily, the production is 12,400 tons every twenty-four hours. Electrical energy is used to a large extent in the entire operations. Preparations are being made to sink another mine of the same size as the last two. This mine will be of modern type of construction.

Different arrangements have been worked out with the operating company, the Peabody Coal Company, so as to stimulate and safeguard the production desired by the central station. From the time the Midland property was bought until Dec. 15, 1913, the amount of coal produced was divided evenly between the Commonwealth company and the Peabody company. Then, under a new agreement, the Peabody company contracted to furnish 1,000,000 tons of coal per year to the Commonwealth company. On May 1, 1917, a supplemental contract was made whereby the Peabody company furnishes an additional 500,000 tons, making a total of 1,500,000 tons. As the requirements of the Commonwealth company for 1917 are 2,1000,000 tons, it is necessary for that company to purchase in the outside market 600,000 tons. The Commonwealth company purposely takes less than its fuel requirements from its own mines, because it is able to buy screenings in the Chicago market at advantageous prices and thus to conserve its own supply longer.

Under the contract the Commonwealth subsidiary, the Midland Counties Coal Company, pays the Peabody company the cost of production plus reasonable charges on a per ton basis for administrative expenses, accident insurance, amortization of bonds and contingencies. Included in the cost of production are bond interest, labor, repairs and mining.

Supervision of the contractual relations between the Commonwealth subsidiary and the Peabody Coal Company is under the direction of the fuel agent of the Commonwealth company and the Public Service company, who also acts in an advisory capacity for the Middle West Utilities Company. Daily fuel statements, showing the cars en route, total supply, etc., are received. An inspector is at the mines all the time, and it is his business to check costs and make suggestions as to economical methods of mining, etc.

COST OF MINES STILL RELATIVELY LOW

The vice-president of the Commonwealth company, under whose jurisdiction the coal mining and purchasing interests of the company are placed, said to a representative of the ELECTRICAL WORLD in commenting on the fuel policies outlined above:

"Ownership of the coal mines assures us of a coal supply in the winter when other sources are overburdened with the general demand. During seasons when there is plenty of coal on the market we are frequently able to buy at low prices, and this reduces our average cost of coal and also protects our own supply. For instance, screenings are often offered in the market at a low price by operators who have sold their lump coal at such a good figure that they can well afford to take a low rate for screenings, for the average obtained in this way is ample compensation.

"The policy of Mr. Insull in planning ahead for years to protect our sources of coal supply has been amply justified by the events of the last twelve months. I should not hesitate to advise other companies to purchase coal lands in order to strengthen their future position regarding the serious problem of coal supply. Although prices of coal mines and land have risen rapidly, the investment cost is still relatively small, and the relief and financial advantages of a reserve supply are demonstrated forcefully by present conditions."

Flexible and Accurate Method for Dielectric Tests

Description of a Series-Inductance Bridge for Measuring Dielectric Energy Losses at Low Frequencies and High Potential Gradients—Method of Using the Apparatus

BY CHESTER ARTHUR BUTMAN

At the present time there is a notable lack of data on the dielectric constants which pertain to a large variety of substances. This bridge affords a means of obtaining the information. As alternating currents are used, no trouble is caused by the dielectric after-effect, as is the case with direct currents. The bridge gives a means of determining the geometric capacity of condensers having a capacity from 1 mfd. to 0.0001 mfd., with one setting of the bridge arms, with an accuracy of about 0.01 per cent of the capacity measured.

The bridge is especially valuable in investigating anomalous dielectrics. The change of a dielectric to the state of a conductor can be traced by changing the temperature.

Moreover, it is now generally recognized that a measure of the dielectric energy loss is the best single test that can be applied to insulation. In designing electrical machinery it is now necessary to take into account, besides the other losses, the dielectric energy loss. This bridge gives a means of determining this loss under the same conditions that obtain in practice.

HAVING had to develop a method of measuring the dielectric losses in insulating materials at low frequencies (60 cycles) and high-potential gradients (31,500 volts per cm.), and believing that the method would be of interest to other investigators, the writer has undertaken, in the following paper, to give full directions for setting up and operating the apparatus used. The equipment consisted principally of a series-inductance bridge (Fig. 4).

While the advantages of this type of bridge had been recognized[1] for measuring small changes in the dielectric loss angle, it was thought that it lacked the flexibility necessary to measure large changes in the angle conveniently. The present series-inductance bridge, as developed by the writer, however, has been found to have such great flexibility that large or small dielectric loss angles can be measured easily. The chief changes made were the development of general formulas for the determination of the geometric capacity, the dielectric loss angle, the total current and the dielectric energy loss, the use of aluminum wire as the vibrator in the Einthoven galvanometer used and the method of grounding adopted.

Meaning of Symbols Used in Development of Formulas

ϕ = phase angle of condensers involved.
$\Theta = 90° - \phi$ = dielectric loss angle.
$\cos \phi = \sin \theta$ = power factor of dielectric.
$P = 2\pi f$ where f is the frequency of the alternating current.
C_x and C_s = geometric capacities of the condenser under test and standard comparison condenser respectively.
r_s = equivalent resistance which would give the same phase-angle displacement ϕ_s when used with a perfect geometric capacity having the same value as C_s as would be actually obtained by C_s.
r_x = equivalent resistance corresponding to C_x.
L_1 = inductance in bridge-arm 1.
L_2 = inductance in bridge-arm 2.
R_1 = non-inductive resistance in bridge-arm 1.
R_2 = non-inductive resistance in bridge-arm 2.
$a_s = r_s - (j/PC_s)$ = impedance in bridge-arm.
$a_2 = R_2 + jPL_2$ = impedance in bridge-arm.
$a_x = r_x - (j/PC_x)$ = impedance in bridge-arm.
$a_1 = R_1 + jPL_1$ = impedance in bridge-arm.

Capacity Equation.—The geometric capacity is the same whether measured by alternating current or direct current and may be obtained from the relation showing the condition of balance for the bridge.—Lord Raleigh[2] and others have shown that the condition for balance in such a bridge is

$$a_s a_2 - a_x a_1 = 0, \qquad (1)$$

or, substituting the values of a_s, a_2, a_x and a_1, multiplying, collecting real and imaginary terms:

Real terms—

$$R_2 r_s + (L_2/C_s) - R_1 r_x - (L_1/C_x) = 0 \qquad (2)$$

Imaginary terms—

$$(-jR_2/Pc_s) + jPL_2 r_s - jPL_1 r_x + (R_1 j/Pc_x) = 0 \qquad (3)$$

From the diagram (Fig. 1) it may be seen that $r + 1/Pc = \tan \theta = Pcr$, whence from (2)

$$\frac{\tan \theta_s R_2 + PL_2}{\tan \theta_x R_1 + PL_1} = \frac{C_s}{C_x} \qquad (4)$$

Equation (4) may be used to determine the geometric capacity of C_x if the geometric capacity of C_s is known. However, for most purposes the capacity equation derived similarly from (4) will be found most convenient:

$$C_x = C_s \frac{R_1 - PL_1 \tan \theta_x}{R_2 - PL_2 \tan \theta_s} \qquad (5)$$

Equation (5) is the equation which has been used in all the subsequent calculations for capacity. If the condensers C_x and C_s are perfect, there will be no dielectric loss angle. Consequently $\tan \theta = 0$, so that the correction term $PL \tan \theta$ will vanish and

$$\frac{C_x}{C_s} = \frac{R_1}{R_2}.$$

Hence, the measurement of the capacity is primarily based on the measurement of the resistances R_1 and R_2. In any case the correction term to be applied is small, although in most cases it is necessary to use the full formula in order to obtain the correct value of the geometric capacity.

It is important to notice that this formula gives the geometric capacity at any frequency and with any dielectric loss angle. Hence the geometric capacity can be determined for a given condition of the condenser by balancing the bridge only once.

Formula for the Dielectric Constant.—The dielectric constant or specific inductive capacity (S. I. C.) for two parallel plates is given by the equation,

$$\text{S. I. C.} = 4\pi DC_x/S \qquad (6)$$

where D is the distance between the plates in centimeters and S is the area in square centimeters of one of the plates. Using equation (5) and substituting in (6)

[1] First proposed by Dr. Rosa and developed for measuring small dielectric loss angles at low voltages, but not for dielectric energy loss, by F. W. Grover. (*Bulletin* of the Bureau of Standards, Vol. 3, 1907.)

[2] *Proceedings Royal Society*, Vol. 49, p. 203, 1885.

$$\text{S. I. C.} = \frac{4\pi DC_s(R_1 - PL_1\tan\theta_s)}{S(R_2 - PL_2\tan\theta_s} \qquad (7)$$

Dielectric Loss-Angle Equation.—Using equations (4) and (5) and equating equals,

$$\frac{\tan\theta_s R_2 + PL_2}{\tan\theta_x R_1 + PL_1} = \frac{R_2 - PL_2\tan\theta_s}{R_1 - PL_1\tan\theta_x}$$

Multiplying out

$$\frac{\tan\theta_s - \tan\theta_x}{1 + \tan\theta_s\tan\theta_x} = \frac{PL_1R_2 - PL_2R_1}{R_1R_2 + P^2L_1L_2}$$

Substituting trigonometric equivalents,

$$\tan(\theta_s - \theta_x) = \frac{P(L_1R_2 - L_2R_1)}{R_1R_2 + P^2L_1L_2} \qquad (8)$$

Or multiplying the equation before (8) by (— 1)

$$\tan(\theta_x - \theta_s) = \frac{P(R_1L_2 - R_2L_1)}{R_1R_2 + P^2L_1L_2} \qquad (9)$$

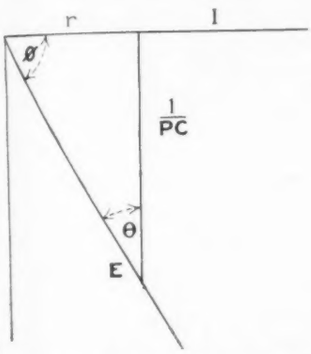
$$I_x = E_xPC_x\cos\theta_x \qquad (11)$$

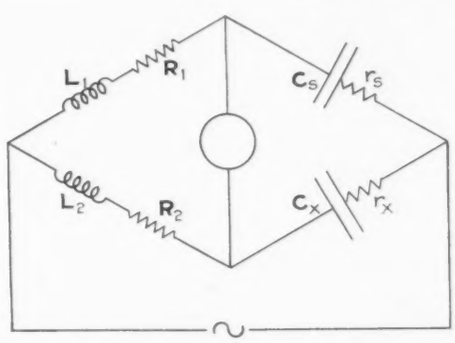
Formula for the Energy Loss.—

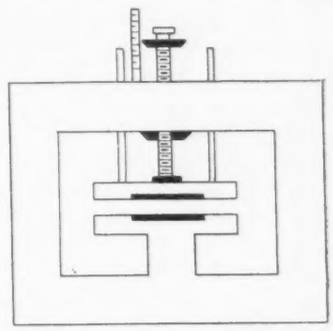
$$\text{Ergs per second} = I_xE_x\sin\theta_x \times 10^7$$
$$= E^2{}_xPC_x\cos\theta_x\sin\theta_x \times 10^7 \qquad (12)$$

An examination of the energy loss formula shows that, at constant frequency, if θ_x and C_x do not change with the strength of field, the energy loss will be directly proportional to the square of the applied potential. Experiments which have so far been made on the change of the capacity with the applied potential show for the most part that there is no change. In any case the change is an extremely small one, so that C_x may be regarded as a constant when measured at different potentials. Therefore, whether or not the energy loss is proportional to E_x^2 depends on whether θ changes with the applied potential.

The experiments which follow show conclusively that







FIGS. 1, 2 AND 3—RELATION BETWEEN E, I, $1/PC$ AND PHASE AND DIELECTRIC LOSS ANGLES; SERIES-INDUCTANCE BRIDGE FOR MAKING DIELECTRIC TESTS; FRAME FOR HOLDING SAMPLES

The dielectric samples (45.72 by 45.72 cm.) were held in place by two pieces of special dried, oil-soaked maple, the same size as the samples. These wooden pieces were made of several layers of wood to prevent warping and of sufficient thickness to prevent bending. In the center of the wooden pieces a square copper sheet (30.48 by 30.48 cm.) was placed flush with the surface of the wood. The copper plates were held in place by screws, to one of which was attached a wire serving as an electrical connection. The lower fixed plate was used as the low-potential side and was supported by a post of treated maple, so that the two plates were highly insulated from one another. No iron was used in any part of the frame.

The upper plate was supported by a brass micrometer screw arrangement. The end of the screw was attached to a metallic piece which allowed the screw to turn but which fitted so tight that there was no play. There was no back-lash in the screw. Two wooden rods attached to the upper wooden piece prevented the upper plate from moving out of position while it was being moved up or down. Hence the copper plates were always lined up in the same way.

If the dielectric loss angle of the dielectric under test is greater than that of the standard condenser, equation (9) is used; if it is less, it will be found necessary to use (8). Using equation (9),

Let $\tan(\theta_x - \theta_s) = \tan A$

then $\theta_x = \theta_s + A$

$$\text{whence } \theta_x = \theta_s + \tan^{-1}\frac{P(R_1L_2 - R_2L_1)}{R_1R_2 + P^2L_1L_2} \qquad (10)$$

It will be noted that the measurement of the dielectric loss angle is independent of the measurement of the capacity. On the other hand, the capacity is dependent on the accurate measurement of the dielectric loss angle.

Formula for the Current.—In developing the bridge formula it has been assumed that a condenser with a perfect dielectric and capacity c is placed in series with an equivalent resistance r. The current through a perfect condenser in series with a resistance is given by the equation

$$I_x = \frac{E_x}{\sqrt{\left(\frac{1}{PC_x}\right)^2 + r_x^2}}$$

where E_x is the effective voltage applied to the condenser. From the diagram (Fig. 2) it is seen that $r_x = \frac{\tan\theta_x}{PC_x}$, whence, substituting and simplifying,

in some cases θ increases and in others decreases as the applied potential is increased. Hence the energy loss is usually not proportional to the square of the applied potential, but may increase faster or slower than E_x^2 as E increases. The governing factor is the product $\cos\theta_x \sin\theta_x$. This product is equal to zero when $\theta_x = 90$ deg., hence there is no energy loss when the condenser has a perfect dielectric. If $\theta_x = 0$ there is also no energy loss, in which case the condenser is a perfect conductor, having no resistance. In this last case the capacity would be infinite and consequently the dielectric constant would also be infinite. The product ($\cos\theta_x \sin\theta_x$) is a maximum when $\theta_x = 45$ deg. Hence, if a substance has a dielectric angle of loss less than 45 deg. it is primarily a dielectric. On the other hand, if θ is greater than 45 deg. the substance is primarily a conductor. Hence, it will be seen that a new and exact definition of a dielectric and a conductor can be given, viz., a dielectric is a substance whose dielectric loss angle is less than 45 deg. A conductor is a substance whose dielectric loss angle is greater than 45 deg.

From the foregoing considerations it will also be seen that if θ increases the substance is becoming more like a conductor. On the other hand, if θ decreases the substance is becoming a more perfect dielectric. Hence, the dielectric loss angle gives the degree of imperfection of the dielectric.

Features of Apparatus Employed.—The standard condenser C_s is a very important part of the apparatus, because the determination of the absolute value of the dielectric loss angle and the geometric capacity of the condenser under test depend upon it. The standard air condenser used consisted of fifty sheet-iron plates with an air space of 2.54 cm. between them. The flash-over voltage was 15,000 volts. The plates were inclosed in an air-tight box which was kept free from moisture by phosphorous pentoxide.

When the condenser was first constructed it was supposed it would have no dielectric loss angle. However, it was found on testing it that on account of the insulation used between the plates it had a small dielectric loss angle. The dielectric loss angle was determined by comparing C_s with two aluminum plates 72 cm. in diameter suspended in air at a distance apart of about 4.5 cm. The upper plate was connected to the high-potential side of the transformer and the lower plate was placed on three large porcelain insulators. The aluminum plates were therefore substituted in place of C_x.

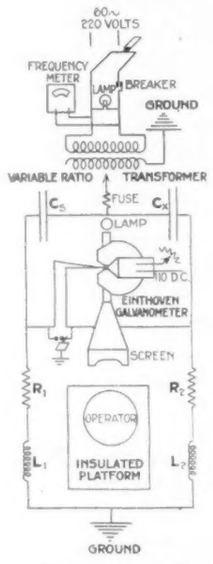


FIG. 4—TESTING ARRANGEMENTS

It will be observed that, provided a spark does not pass between the plates, the distance apart is not important as the dielectric loss-angle measurement is independent of the capacity. Under these conditions it was found that the absolute value of the dielectric loss angle of the standard condenser was 0 deg. 54 min. 25 sec. $\pm$ 20 sec. The testing voltages applied were from 1500 volts to 4000 volts inclusive. Numerous independent check tests have made it certain that the value obtained is correct. The corresponding power factor $\sin \theta_s = 0.01583$.

Effect of Applied Potential on Dielectric Loss Angle.—It is important to know whether the dielectric loss angle of the standard condenser changes with the applied potential. This point was tested by placing the testing frame (see Fig. 3) in the bridge arm as C_x. The plates of the frame were widely separated and the bridge was balanced at 2000 volts. Then the voltage was raised in steps to 10,000 volts, no change being found necessary from that obtained at 2000 volts. This proved conclusively that there was no change in the dielectric loss angle of the standard condenser due to a change in voltage.

The dielectric loss angle of the standard condenser was constant over a long period of time, as was shown by check tests made on a standard sample of micarta from time to time.

Capacity of the Standard Condenser.—The capacity of the standard condenser was obtained by comparing its capacity with a standard mica Leeds & Northrup condenser, with a Westinghouse condenser terminal of known value, and a section of a cable that had been tested in another laboratory. The value of the capacity of all the plates of C_s in parallel was found to be 0.012000 microfarad.

The value of the capacity was found not to change with a change in the applied potential, or to change over a long period of time, the tests being similar to those made for the constancy of the dielectric loss angle.

Testing Frame.—A special testing frame was designed by the author in order that the dielectric constant could be determined with accuracy at the same time the other measurements were made. It is important that the distance between the plates be accurately known and that it does not change because of the stress produced by the potential. This frame also serves to hold the dielectric under test in a convenient manner and does away with the necessity of attaching condenser plates by means of shellac, etc., to the samples of dielectric under test. The frame also provides a means whereby a liquid can be tested so that nothing but the dielectric under test is between the condenser plates (Fig. 3).

The frame had no leakage, as was shown by the test of the standard condenser already mentioned. The matter of edge correction is of no importance as the correction is so small it can be neglected.[8] When the distance between the plates $D = 0.3175$ cm., then the S.I.C. $= 3865.2\ C_x$.

Corona Effect Avoided by Immersion in Oil.—As it was impossible to test dielectrics at high voltages in air on account of the corona effect, it was necessary to test them under oil. The oil used had a paraffine base and was free from moisture. The tank was a large transformer case which was surrounded on the outside by several layers of fullerboard to prevent radiation. It took three days for the tank of oil to cool from 100 deg. C. to room temperature. The heating of the oil in the tank was regulated by large electric grid heaters placed in the bottom of the tank in contact with the oil. The current through the heaters was controlled by an auto-transformer.

Source of Potential.—The source of potential was a 60-cycle alternating-current generator, giving a sine wave as shown by the oscillograph. The voltage and frequency were constant with the accuracy usually obtained in practice. The frequency was obtained from a frequency meter, and the potential across the condenser terminals was obtained (when required) by an auxiliary measuring transformer not shown in the diagram. The value of the potential was adjusted by means of a Westinghouse 10-kw. variable-ratio testing transformer, the primary of which was connected to the source of the potential. The transformer had a range from zero to 10,000 volts in 200-volt steps, or zero to 5000 volts in 100-volt steps. One side of the secondary was grounded, and the other side leading to the bridge had a fuse in it to break the current in case the condenser under test broke down.

The Resistances.—The resistances used were of the Leeds & Northrup non-inductive dial type. The resistance in one arm had a range from zero to 100 ohms in 0.1-ohm steps. The resistance in the other arm had a range from zero to 8000 ohms in 10-ohm steps. It should be noted that the resistance of the inductance in each arm must be added to that of the variable resistance. The resistance of the bridge wires was neglected as they were 0.2032 cm. in diameter. All joints in the bridge were soldered.

The Inductances.—The standard fixed inductance

[8] J. A. Pollock and O. U. Vonwiller, *Phil. Mag.*, Vol. 3, p. 589, 1902.

was made by Leeds & Northrup and had a range from zero to 100 millihenries in 2.5-millihenry steps. The variable inductance was of the Ayrton-Perry type and was made by Leeds & Northrup. It had a range of 6 to 43 millihenries, being graduated in millihenries so that tenths of a millihenry could be estimated accurately.

Vibration Galvanometer.—The Einthoven vibration galvanometer used was made by the Cambridge Scientific Instrument Company, England. It is essentially a light current-carrying wire placed in a strong electromagnetic field. An increase in the current causes the wire to be deflected by the mutual electromagnetic repulsion. A notable improvement in the usual method of using it was made by placing the vibrator directly in the circuit as shown in the diagram. The galvanometer frame is usually grounded, but in this case the frame was removed as far from ground as possible. This was done by placing sufficient insulation between it and the pier on which it was placed. The pier was free from vibration. The change in the method of grounding also made it necessary to reconstruct the case which holds the vibrator so that the case would be insulated from the vibrator. Thus the vibrator was insulated from the frame.

By using this method the use of an auxiliary bridge for balancing the capacity of the main bridge to ground, as used by K. W. Wagner and others, was avoided. With this method it was also found unnecessary to use a substitution method in measuring the capacity as described by F. W. Grover.[4]

The vibrator was illuminated by an incandescent lamp and its shadow was allowed to fall on a ground glass screen 114.3 cm. distant. The screen was inclosed in a box from which all stray light was excluded while being observed. By focusing, the edges of the shadow of the vibrator could be sharply defined so that a slight vibration could be readily detected by noticing the relative blackness of the edges as compared with the central portion. The galvanometer is used simply as a detector as to when the bridge is balanced. When the bridge is balanced the vibrator has no motion. A short-circuiting switch protected the galvanometer during adjustment.

No trouble was experienced in tuning, and the vibrator usually remained in adjustment during a series of readings. The adjustment was facilitated by a belt-like arrangement which ran from the tuning device on the galvanometer to a roller above the ground-glass screen.

When the galvanometer was first used it had a silver vibrator. This vibrator was very sensitive to a change in resistance, but was comparatively insensitive to small changes in the inductance. On account of the sensitiveness of the bridge to changes in the resistances which cause a relatively large change in the current, it is possible to obtain an approximate value of the capacity when it is impossible to make an accurate measurement of the dielectric loss angle. This is illustrated by the fact that with all of the substances examined at room temperature it was found impossible to use a potential gradient less than 3150 volts per centimeter and obtain the dielectric loss angle with accuracy. However, the galvanometer was still sensitive to small changes in resistance so that capacity could be determined to a degree approximating exactness.

The two factors[5] which determine the sensitiveness of a vibrator are its conductivity and its mass. A metal which has a high conductivity for its mass is aluminum. A wire of this material 0.0762 cm. in diameter when used as a vibrator was found to increase greatly the sensitiveness of the galvanometer to small changes in inductance. It is essential that small changes of inductance be detected in order that the dielectric loss angle and the dielectric energy loss be determined accurately. The choice of a vibrator is a very important one when 60 cycles is used because the galvanometer becomes more insensitive the lower the frequency becomes.

General Considerations.—The bridge wires and the various portions of it were arranged in a symmetrical manner. In this way the capacity relative to ground of the different arms of the bridge was symmetrically distributed. Since it is important that the capacity to ground be reduced to the least possible amount, the bridge wires, for the most part, were placed high in the air. There was no mutual induction of an appreciable amount between the different units of the bridge. Strong, steady electrostatic and electromagnetic fields caused no difficulty in operating the bridge.

Since results can be compared only when they are obtained at the same potential gradient as well as the same temperature and frequency, it is necessary to know the distance between the plates in order to determine the exact potential gradient as well as the specific inductive capacity. The two factors which determine the potential gradient are the applied potential and the thickness of the material. As these can both be varied, a wide range of gradients is available with the maximum applied potential of 10,000 volts. The practical limits are, on the one hand, the insensitiveness of the bridge to a change in inductance with a gradient less than 3150 volts per centimeter, and, on the other, the breakdown strength of the material.

Manipulation of the Bridge.—The bridge is adjusted best by first finding an approximate adjustment of R_1 and R_2, then of L_1 and L_2, then make a final adjustment of the finer resistance, then make a final adjustment of the variable inductance. If the bridge is working properly, a change of 0.1 ohm greater or less in the resistance, or of 0.1 millihenry greater or less in the inductance, should cause a change in the balance of the bridge.

The bridge is best manipulated when R_1 is about equal to R_2. This is secured by making the capacity of C_3 about the same as that of the condenser under test. However, the bridge has been found to be accurate when the ratio of the resistances was sixty to one. The amount of resistance to be used is dependent on the number of significant figures required in the capacity calculations, and on the amount of current flowing through the bridge. The more current flowing in the bridge the more sensitive is the galvanometer. However, care must be taken that the current is not too great, otherwise the vibrator will burn out. The greatest current passing through a condenser under test at any time was 0.36125 amp. and the smallest was 0.000371 amp.

The resistances and inductances can be chosen so that, however small the difference between R_1L_2 and

[4] *Bulletin*, Bureau of Standards, Vol. 3, p. 392, 1907.

[5] Einthoven, *Ann. der Phys.*, Vol. 1, pp. 483, 665, 1906.

R_2L_1 becomes, it can always be made the difference between two *large* quantities. In this fact lies the great advantage of the series inductance method for the measurement of small differences in the dielectric loss angle.

If the dielectric loss angles are large (for instance 35 deg.), it is sometimes convenient to use the bridge with $L_1 = 0$. In this case tan $(\theta_x - \theta_s) = PL_2/R_2$ and the calculations are much simplified. However, this is not a convenient formula to use for small dielectric loss angles (such as 14 deg.) because it is difficult, practically, to make L_2 sufficiently small, or R_2 sufficiently large. Hence it will be seen that this method has great flexibility and is capable of universal application in this field of work.

There is always the possibility that the condenser under test will break down. In this case the operator is protected somewhat by the insulated platform. The circuit has a fuse and breaker in it which also afford some protection.

The experimental part of this paper was done at the high-tension research laboratory of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., of which C. E. Skinner is director.

Selection of Motors for Shipbuilding Plant

Conditions Influencing Individual Drive and Determination of Proper Rating, and Some Characteristics That Have Been Found Requisite in Motors for Plate-Shop Machines

BY DAVID ELWELL

Electrical Engineer Lockwood, Greene & Company

ONE of the largest and most complete hull, engine and boiler plants along the Atlantic coast for the construction of steel vessels is being rapidly completed for the Staten Island Shipbuilding Company at Mariners' Harbor, New York City. The yard is built on the site of an old plant formerly used by the company for the construction of wooden vessels and equipped with a 220-volt direct-current power plant.

The first of the buildings in the new development to be completed was the plate shop, in which the steel for plating the hulls is prepared. Since it was necessary to put this shop in service as soon as the building was up, and as the question of electric power supply for the whole plant had not been worked out at that time, the direct-current energy then available was used. The machine tools listed in the accompanying table were installed and equipped with individual motors, in most cases belted directly to the machines.

CONDITIONS INFLUENCING INDIVIDUAL DRIVE

Every consideration involved in connection with the plate-shop machines led to individual drives. Neither the type of building, the arrangement of machines nor the operating conditions surrounding the use of them makes group drives desirable.

The building is a high studded steel-frame building with peak roof and two longitudinal bays, with a traveling crane in one of them. Under these circumstances the shafting necessary for group drives would be cumbersome and expensive. Furthermore, in order to secure sufficient space around the machines for handling the large plates and angles that are being fabricated considerable clearance had to be left between machines. This would further add to the expense of providing group drive.

The other controlling factor is the fact that while the final product of the yard may be standardized (*i. e.*, a number of identical vessels) on a given contract, each machine tool is used for several operations. The work on any given machine is, therefore, very much of a "jobbing" proposition, and the use of any machine is required for long or short periods at indefinite intervals. To give the greatest flexibility of service, maximum utility and the lowest power cost for the output involved individual motor drive was therefore chosen without question.

The arrangement of tools in the plate shop and routing of materials to and from other buildings is shown

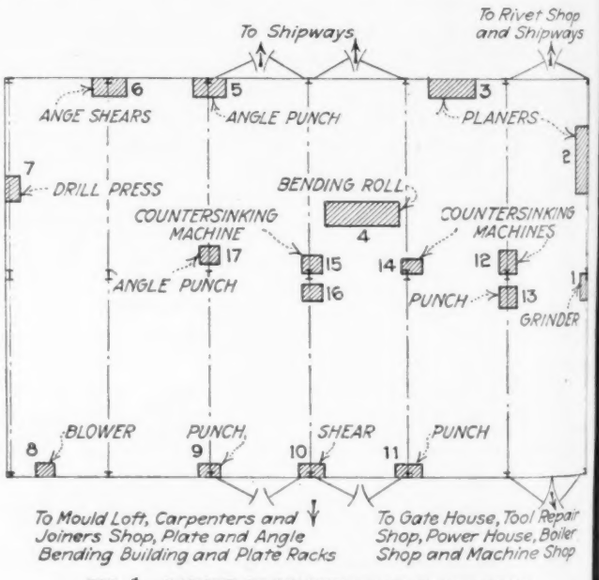


FIG. 1—LAYOUT OF MACHINES IN PLATE SHOP

in the accompanying diagram. The demand for immediate operation was so pressing that no opportunity was offered for any testing, and the motor sizes were chosen with the idea of not having them too small even if they were too large.

Soon after the building had been successfully put into service the question of permanent electric power supply for the plant was taken up, the old direct-current plant being entirely inadequate for the requirements of the new yard and occupying a site needed for other buildings. As pointed out in the Jan. 5 issue of the ELECTRICAL WORLD, a careful analysis of all power requirements led to a contract for alternating-current ser-

vice being entered into with the Richmond Light & Railroad Company.

The necessity of changing the motor drives from direct current to alternating current for operation on the purchased-power lines therefore afforded the opportunity for determining the actual duty cycle of work on the machines and the proper alternating-current motor to install. Ammeter and voltmeter readings were taken on the individual direct-current motors on each of the drives, with the results which are given in Table I.

Determination of Proper Rating

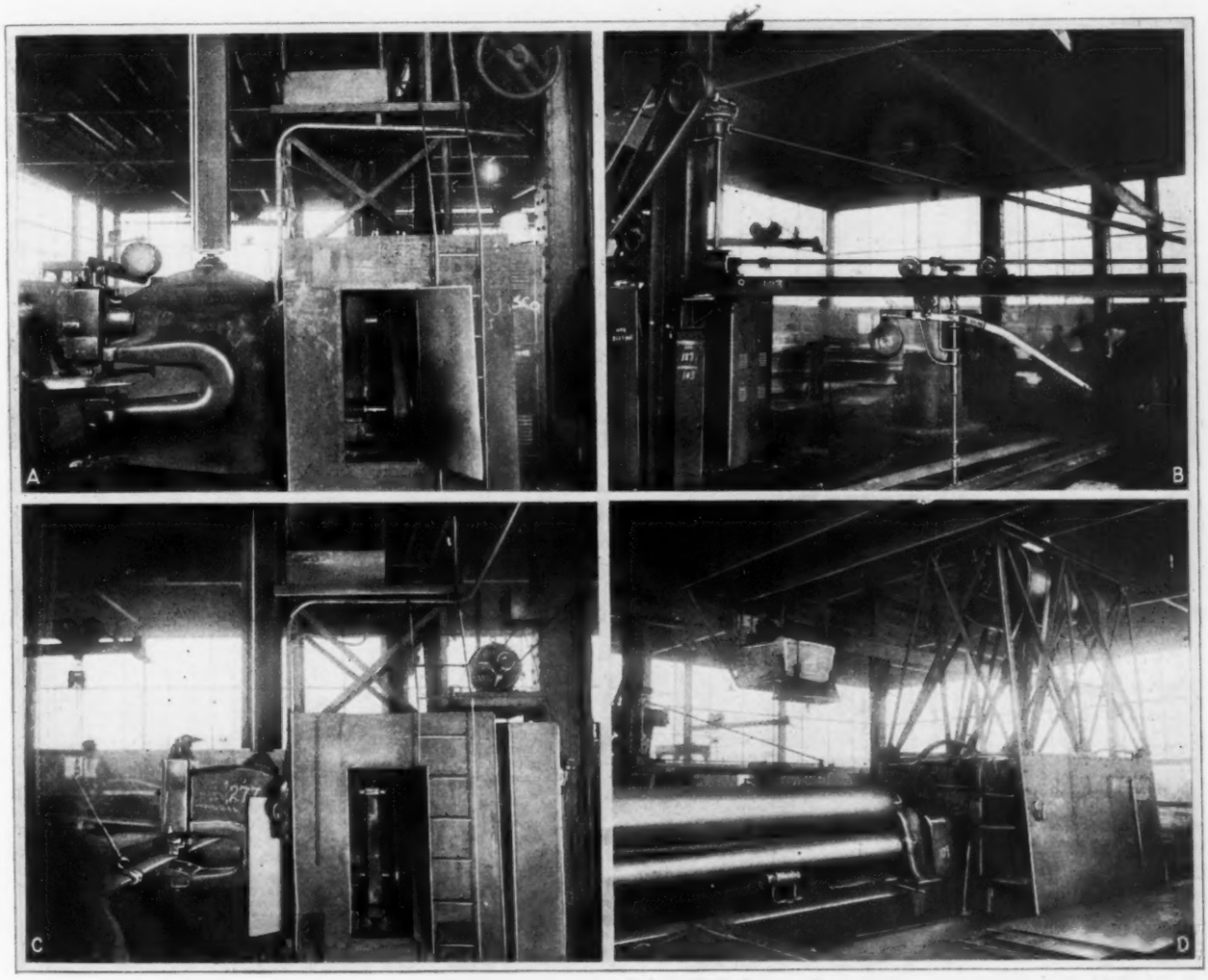
Considering the test data on the direct-current motors, item 1 is the conventional grindstone and emery wheel used for sharpening the shop tools. The motor drives a small counter-shaft from which both grinding wheels are belted. This group was found to be considerably over-motored, a 2-hp. motor proving sufficient for the load.

The plate planers (items 2 and 3) have long beds, on which the plates whose edges are to be planed are placed, the plate being held firmly by adjustable jack screws on the upper frame of the machine. The cutting tool is held on a carriage which travels parallel to the edge of the plate on a long screw. The tests showed that both the plate planers were considerably over-motored as then equipped and that 10-hp. and 15-hp. motors for items 2 and 3 respectively would be found to be ample.

The bending rolls (item 4) are for bending plate cold into circular shape, the relative location of the rolls being adjusted manually to increase the curvature as the plate is passed back and forth through the rolls. The motor is belt-connected with a counter-shaft from which open and crossed belts operated by a shifter drive the rolls in either direction. While the rolls were equipped with a 30-hp. motor, the tests indicated that a 25-hp. motor was proper for this drive.

Instead of a 10-hp. motor on the drill press and blower (items 7 and 8), 3-hp. and 5-hp. motors respectively were found of ample size. On the countersinks (items 12, 14 and 15) a 5-hp. motor for No. 12 and 3 hp. each for the other two were found to be suitable.

No unusual starting conditions existed in connection with the foregoing drives. On some of them the motor is started light and the load applied by shifting the belt, and on others the tool starts directly with the



INCLOSURE OF GEARS AND FLYWHEELS AND ELEVATED POSITION OF MOTORS TYPICAL OF STATEN ISLAND SHIPBUILDING COMPANY'S PLATE SHOP

A—Plate punch No. 13 with door to gear and flywheel housing open; the driving motor is situated on the elevated platform. B—Countersinking machine No. 15 driven by motor just above the pivoted end of the swinging arm. C—Plate shear No. 16; the flywheel and gears are inclosed and the motor elevated. D—Plate-bending machine No. 4; the metal inclosure at the right serves as a control house and also to protect the workmen from the gears and to house the motor.

motor; but as there is little inertia to overcome on account of the absence of flywheels, etc., standard squirrel-cage motors were used.

The most interesting motor applications are the punch and shear installations (items 5, 6, 9, 10, 11, 13, 16 and 17). They are low-speed machines and ones in which the working interval is very short, being simply the stroke during which the tool is punching or shearing. At that moment, however, the instantaneous power requirement is very heavy. Rather than use a motor big enough to carry the tool through its working stroke, the machine-tool designers adopted the wise expedient of using a heavy flywheel, which stores up energy when the machine is running light and delivers it as the machine slows down on the cutting stroke.

The presence of the flywheel permits a much smaller motor than would otherwise be required, but proper acceleration of the machine presents quite a problem. The severe starting conditions which resulted are indicated by the accompanying test data.

TABLE I—DATA ON PLATE-SHOP ELECTRIFICATION (STATEN ISLAND SHIPBUILDING COMPANY)

Machine No.	Machine	Original Direct-Current Motor			Work During Test	Maximum Expected Work	Hp. Input to Motor While			Note*	Expected Maximum Load, Hp.
		Hp.	R.P.M.	Pulley Diam. In.			Starting	Running Light	Working		
1	Grindstone and emery wheel	3.5	1800	4	.....	.....	3.2	0.9	2.3	...	2
2	Niles Tool Works 25-ft. plate planer	15	1000	7.5	½-in. plate	½-in. plate	20	2.3	4.4	...	9
3	Hilles & Jones 30-ft. plate planer	20	950	14	½-in. plate	½-in. plate	22	3.5	6 2	...	12
4	Niles Tool Works 18-ft. bending rolls for ½-in. plate, main roll 21 in. diameter	30	600	15	½-in. plate	½-in. plate	26	4.4	2.3	...	30
5	Hilles & Jones angle punch	7.5	475	7.5	¾-in. angle	¾-in. angle	11.7	1.5	2	F	4
6	Hilles & Jones angle shears	7.5	825	6	⅞-in. angle	¾-in. angle	7.3	1.5	2.3	F	5
7	Drill press, 2½ in.	10	730	12	½-in. hole	1½-in. hole	8.8	1.8	2	...	5
8	Blower for forge	10	730	20	.....	.....	11	2.6	2.6	...	5
9	Hilles & Jones No. 4 plate punch	7.5	825	6.5	¾-in. hole ¾-in. plate	1-in. hole 1¼-in. plate	11.5	2	2.6	F	5
10	Long & Allstatter No. 2 plate shear	5	550	6	⅞-in. plate	¾-in. plate	8.8	1.5	4.1	F	5
11	Long & Allstatter No. 2 plate punch	5	550	6	¾-in. hole ¾-in. plate	1-in. hole 1¼-in. plate	8.8	1	2.6	F	5
12	Detrick & Harvey radial countersink	6	1465	5.5	.....	.....	7.3	2.9	4.7	...	4
13	Cleveland Punch & Shear Company's plate punch	7.5	475	7	⅞-in. hole ⅞-in. plate	1-in. hole 1⅛-in. plate	11.7	1.2	3.8	F	5
14	Detrick & Harvey radial countersink	3.5	625	10	.....	.....	6.8	1	2.6	...	3
15	Fitchburg Machine Works radial countersink	3.5	625	10	.....	.....	6.8	1	2 6	...	3
16	Long & Allstatter No. 1 plate shear	7.5	475	7	¾-in. plate	¾-in. plate	11.7	1.8	3.2	F	5
17	Angle punch	7.5	825	8	⅞-in. angle	¾-in. angle	11.7	1.5	2.3	F	3

*F—These machines provided with fly-wheels.

Some Factors That Affect Selection

Three important points which have to be recognized in the selection of a motor are the power required to start the machines, that required to run them, and the maximum horsepower necessary which the motor can develop at starting without throwing off the motor belt.

The tests indicated that 9 hp. to 12 hp. was necessary to start the punching and shearing machines. Since a standard squirrel-cage motor of about the sizes required would only develop a starting torque equivalent to one to one and a half times full-load torque, it is evident that a motor of proper size to handle running conditions would stand no chance of starting these machines under the conditions shown to exist. If the driving belt happened to be too loose, the motor pulley might slip and throw it off, but it could not develop sufficient torque to meet the starting requirements indicated by the test. If a starting compensator were used, it would lower the starting torque still further by reducing the applied voltage. For these reasons it was impossible to use a standard squirrel-cage motor either with or without starting compensator.

The proper drive for punching or shearing machines is therefore one which gives a powerful yet gradual starting characteristic. This may be secured from an alternating-current motor with slip rings and external starting device or from a squirrel-cage motor with high-resistance end rings. From the standpoint of simplicity, price and quick delivery, the high-resistance end-ring type was considered preferable, as a number of manufacturers carry a stock for elevator service.

When this type of motor is thrown directly on the line the high resistance in the rotor end rings causes considerable slip at starting, allowing the motor to accelerate powerfully and yet gradually. Another advantage of the high-resistance type is its falling speed characteristic with increasing load, which results in an increasing torque and helps the flywheel over the peak of the load. The speed-torque characteristics of this motor are very similar to that of the series direct-current motor used for traction purposes, and they fit it admirably for this work. The greater complexity of the slip-ring motor and its susceptibility to trouble

TABLE II—ALTERNATING-CURRENT EQUIPMENT INSTALLED IN PLATE SHOP (STATEN ISLAND SHIPBUILDING COMPANY)

Mach. No.	Machine	Hp.	A. C. Motors Installed			Starting Device†
			Type*	Full Load, R.P.M.	Pulley Diameter, In.	
1	Grinders	2	S	1720	4.5	A
2	Plate planer	10	S	1150	6.5	B
3	Plate planer	15	S	1740	7.5	E
4	Bending rolls	25	S	1160	8.0	E
5	Angle punch	5	SH	680	5.5	C
6	Angle shears	5	SH	850	6.0	C
7	Drill press	3	S	1730	5.0	D
8	Blower	5	S	1735	8.5	C
9	Punch	5	SH	850	6.5	C
10	Shear	5	SH	680	5.0	C
11	Punch	5	SH	680	5.0	C
12	Countersink	5	S	1730	4.5	C
13	Punch	5	SH	680	5.0	C
14	Countersink	3	S	1730	4.0	D
15	Countersink	3	S	1730	4.0	D
16	Shears	5	SH	680	5.0	C
17	Angle punch	5	SH	850	8.0	C

*S=squirrel-cage motor, standard design; SH=squirrel-cage motor with high-resistance end rings.

†A=three-pole, 250-volt, 30-amp, inclosed switch fused for 20 amp.; B=three-pole, 250-volt, 100-amp. inclosed switch fused for 90 amp.; C=three-pole, 250-volt, 60-amp. inclosed switch fused for 50 amp.; D=three-pole, 250-volt, 30-amp. inclosed switch fused for 30 amp.; E=starting compensator arranged for conduit wiring with inverse-time-element overload and no-voltage-release coils.

from dirt and grit in machine shops were other factors which affected the selection of high-resistance end-ring squirrel-cage motors for the punching and shearing machines.

The only compensators in the shop are used on items 3 and 4. These were necessary, as the motors are rated in excess of 10 hp., the compensator being used to limit the inrush of current at starting.

On the other motors, because of their small size, no compensators are necessary to limit the starting current, while on the high-resistance end-ring motors no compensator is permissible, as full line-voltage is necessary on these motors to give the proper starting torque.

A motor voltage of 220 was chosen for the plant to secure maximum safety for the operatives. With this low voltage it was not necessary to use oil circuit breakers for starting the motors, so safety inclosed fused knife switches were chosen. The switch is opened or closed by a handle outside and offers complete safety for the operative.

To take the large starting current of the squirrel-cage motors it was necessary to fuse their switches so heavily that no protection is afforded to the motor at moderate overload. In case of grounds or dead short circuit in the motor, however, the fuses would cut it off. With individual motors on machines which are always under the eye of the operative there is little chance for overload on the motor which the operative will not know about. The plant was designed and equipped under the supervision of Lockwood, Greene & Company, Boston and New York.

Utilization of Second-Hand Line Materials

Some Material of This Description Can Be Renovated and Utilized for Service Which Is Not So Exacting as the Use for Which It Was Originally Intended

BY L. M. KLAUBER

Superintendent Electric Department San Diego Cousolidated Gas & Electric Company

NEVER before has there been such a need for increased economy of operation and for more efficient utilization of labor and material. Of course, economy must not be allowed to interfere with maintaining a high standard of service; but, in attempting to decrease expenses by the standardization of equipment and the adoption of more efficient or durable apparatus, sight should not be lost of the economy of utilizing discarded material and equipment. Here is where the construction department, which acts in the capacity of contractor to the operating department, has an opportunity to determine how this so-called scrap material can be utilized to best advantage.

With the increased cost of all raw materials, a careful study of scrap, that is, material which can be disposed of only as junk, should be instituted by all central stations. Metals, alloys, scrap rubber, etc., should be carefully segregated as to quality, so that the highest price may be obtained for each. The degree of segregation which should be practiced will depend upon the specific conditions in each case, the quantity of each class of scrap accumulated, and proximity to raw material markets. Disposal direct to junk dealers will save much trouble, but in any case a certain segregation is advisable. A miscellaneous scrap heap is the junk man's picnic; he pays a skim-milk price, based on the least valued metal in the pile, and then separates the cream in the privacy of the junk yard. Other material and equipment can be renovated and used for a new service which is not so exacting.

METHODS OF UTILIZING OLD POLES

Poles form the greatest bulk of distribution plant removed. Poles of adequate length and size can be retreated and used again, if not too badly deteriorated; others may be too light or too worn. It becomes necessary, therefore, to segregate returned poles into three general groups—those which may be reissued as poles for standard work, those too light or short for such work, and those no longer of any value as poles.

Retired poles which are deemed adequate to re-use as such by a power company must first be carefully examined for soundness. The butt can usually be sawed off about 6 in. (15.2 cm.) above the old ground line if weakened by decay. In fact, it usually pays to discard the butt if decay has advanced beyond a surface sap rot. Sometimes about 3 ft. (0.9 m.) of the butt can be removed so that when the pole is reset the deteriorated portion falls so far below the surface that it will not be subject to rot. In any case the pole should be carefully treated to arrest further decay, otherwise the life after reinstallation will be short. Brush treatment is better than nothing, but an open-tank treatment is much to be preferred.

In these days of greater strength of construction and wider clearances, the 30-ft. (9.1-m.) poles with 5-in. (12.7-cm.) tops, commonly referred to by linemen as "toothpicks," have little place. In a rapidly growing community they accumulate in considerable quantities. Installation on rural branch lines often solves the problem of their disposal. In some locations villa lots are so large that a special-service pole is required between the main lead and each house. An old 30-ft. or 25-ft. (9.1-m. or 7.6-m.) pole serves well for this purpose. Short poles can sometimes be used in rolling country on long-span work, where necessary clearances can be secured by taking advantage of the hilltops. A short pole as a push brace will often solve a difficult problem where anchor rights cannot be obtained. One avenue of disposal of light poles which must not be overlooked is to communication companies. Telephone and telegraph construction, especially in rural districts, is ordinarily of lighter quality than that of supply lines, and often a lot of light second-hand poles in sound con-

dition can be disposed of to such companies at a price well above scrap value.

If a pole is no longer fit to use as such, the next best service to which it can be put is as a guy stub. Ordinarily a guy is a poor location for second-hand material, since failure is expensive and care must be taken not to employ stubs that are too light. If insufficient for use as stubs, poles may be cut up as anchor slugs or for crib-bracing unguyed poles under strain. Light pieces may be sold to farmers for fence posts. Poles are useful in all heavy construction work and can be disposed of to contractors, house movers and the like. Square redwood poles were once used considerably in some parts of the country before the price became prohibitive. They may be sawed up and put to a variety of uses, particularly in rough building work. They are also valuable in the construction of mudsills, bog shoes or crowfeet for holding poles in marshy ground, owing to the durability of redwood in the presence of moisture. A piece of redwood makes an especially good anchor slug.

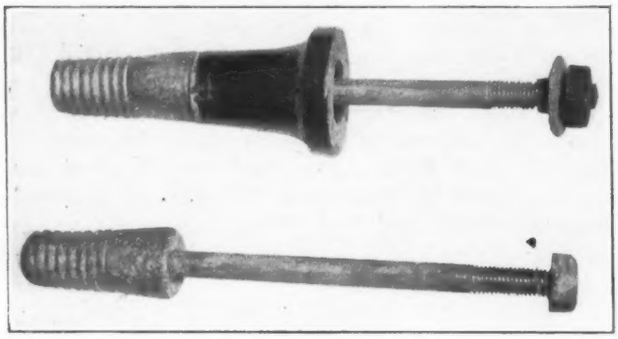


FIG. 1—WOOD THIMBLES ON PINS REPLACED WITH LEAD THIMBLES CAST IN HOME-MADE MOLDS

Failing in all other uses, poles may be cut up for firewood. Yet they are not so well adapted to this use as might be thought. Cedar soon chars in the ordinary fireplace and burns with difficulty. It is a fact testified to by many operators that a pole which catches fire from a defective insulator will easily burn down at 2 a. m. in a heavy rainstorm, but will when cut and dry stubbornly refuse to burn up in a perfectly good fireplace.

USE OF DISCARDED CROSS-ARMS

Non-standard cross-arms, even though in good condition, are difficult to place, since they will not match with new material and are especially bothersome when double-arm pairs are desired. Older cross-arms are liable to be small in every dimension—shorter, of smaller cross-section or with less clearance between pinholes. The clearance between the pins next to the pole is often less than permitted by law or good practice. A solution of the difficulty as to second-hand arms lies in their use as service buck-arms. Though more expensive than brackets, the buck-arm has advantages as to clearances, making a neat and safe installation, especially where a number of services leave a pole in a variety of directions.

One company which utilizes retired non-standard arms for buck-arms places an average of 2000 arms per year in such service, thereby utilizing the entire non-standard accumulation. If these second-hand arms are found to have a "pole pin" separation too narrow to comply with standard practice, it is a good plan to fill one of the pole-pin holes with a 1½-in. (4.31-cm.) wooden plug which can be nailed in place. A new through-bolt hole can then be drilled about 4 in. (10.16 cm.) off center toward the plugged hole and the arm mounted off center. This increases the clearance between the remaining pole pin and the pole by 4 in. Three pin positions remain available for use, these being all that are required for a lighting service. The offset buck-arm does not look bad on a pole, and, besides the advantage of increase clearance, it permits the use of one short or non-standard cross-arm brace with each arm, thus utilizing an additional second-hand item (see Fig. 4).

Other uses to which old cross-arms may be put are those which might be filled by any lumber of similar size, such as fence posts for wire fences, blocking for the storage of poles, cross-arms and other materials, cross-pieces for pole-hole covers, and, in general, rough construction work.

REINSTALLING OLD WIRE

Weatherproof copper wire removed from the lines should be carefully examined before it is reinstalled. If the impregnating compounds have been fried out, it will be better to skim it at once and use it where bare wire is permissible rather than to have it become stringy and an eyesore in a short time. Many places will be found in suburban and agricultural districts where bare wire is as useful as weatherproof, provided that it has retained its strength. Some of the very oldest wire removed, particularly solid wire in sizes from No. 2 up, will be found to be crystallized and weakened by repeated bending. Such wires should not be reinstalled on the lines, as they will only result in failures. In reeling up second-hand wire for line use, the old splices should be carefully examined. Many will be found weak and of poor workmanship, since splicing was not so carefully done in the old days as now.

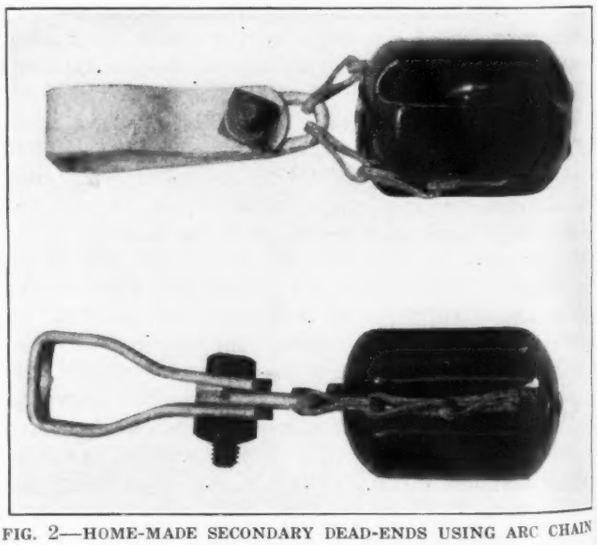


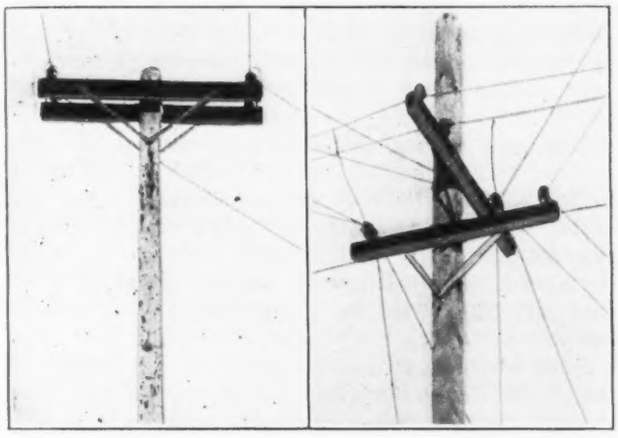
FIG. 2—HOME-MADE SECONDARY DEAD-ENDS USING ARC CHAIN

Short lengths of good quality, either weatherproof or bare, should be saved for ties. Annealed wire makes a better tie than medium hard-drawn, particularly when tying bare wire with bare wire. If wire is annealed and the insulation is removed by burning, the fire

should be started in the open, not in any form of furnace, and the wire must not be allowed to become overheated or it will lose its strength.

One use to which larger sizes of copper can be put after the insulation has worn off, and even after the wire has crystallized, is for grounded neutrals in underground secondaries. Where secondaries are well grounded at transformers and where practically every service conduit is likewise grounded and tied to the neutral, insulated neutrals would appear an unnecessary expense. Such systems are in operation, using bare neutrals entirely from the transformers to the various branch terminals at customers' entrance fuses, and no difficulties have been experienced due to loading and heating of adjacent cable coverings by leakage currents.

Bare scraps may be used as ground wires on transformer poles, provided that the vertical run is covered



FIGS. 3 AND 4—UTILIZATION OF OLD POLES AND CROSS-ARMS

Fig. 3 is a square redwood pole originally set in 1888, removed in 1913, cut from 45 ft. to 40 ft. and now doing duty in a suburban line. The pole was in service thirty years and is good for twenty more. Fig. 4 is an offset service buck-arm using second-hand arm and one short brace.

with a wood molding or fiber conduit, as is usually done even where non-weatherproof wire is employed.

PLACES FOR RETIRED INSULATORS

Insulators, especially pin-type insulators, present a different problem. Unless entirely destroyed they are more liable to be unsuitable because of inadequacy than because of deterioration. Owing to developments made by the manufacturers, greater factors of safety can be required and are used than were deemed necessary some years ago, so that many of the insulators being retired may no longer be utilized for their designed voltage. Companies having lines of various voltages are sometimes enabled to use old insulators on lower-voltage systems. This seldom pays, however, if the voltage steps are large, so that cumbersome insulators, subject to breakage and unnecessarily large pins, must be provided for use at the lower pressure. Some companies serving extensive territories in which a variety of service conditions are encountered find that insulators which have become inadequate in one district may be utilized for lines of similar voltage in sections where conditions are less severe. For instance, companies with lines along the seacoast may find that insulators which have proved to be inadequate under fog and spray conditions will give perfect service on the same lines in interior valleys.

Glass insulators, even of obsolete type, will ordinarily be found useful on secondary systems, provided that they have standard pin holes. Sizes smaller than those now standard for line construction should be used on service brackets.

On the whole, porcelain insulators, on account of their limited uses, offer a difficult problem when obsolete, and large numbers must be scrapped. It pays to have a few old types available for emergency connections and testing about any plant, for insulating stools and staging and for temporary service during construction work.

Strain insulators are more flexible devices, and if in good condition use may be found for most obsolete types. Glass "bobs," formerly used in large quantities in guys, are being abandoned for more dependable porcelain, but they will be found quite adequate for the house ends of service loops. They may also be used in the lighter types of guys, such as arm and bridle guys, and in dead-ending light secondaries. Two-bolt and small obsolete three-bolt guy chains should also be used up on these light guys.

Some prototypes of the modern clevis cap suspension insulator which are useful in dead-ending 11-kv. to 22-kv. lines are with difficulty made up into strings, as they have an eye at each end. These may be made up into neat pairs by using one new clevis cap unit at the line end of each pair, thus eliminating connecting links.

USES FOR OLD PINS, SPACE BOLTS, ETC.

The lead bushing is an exceedingly useful device in remodeling metal pins. Combination pins having a steel through bolt, porcelain base and wood thimble are becoming obsolete with most companies in high-voltage work, owing to the rapid digesting or destruction of the wood. The wood thimbles may be readily split off, and by means of plaster-of-paris molds these may be replaced by new lead thimbles, resulting in a pin actually superior in strength and durability to the original article. Renovated pins of this type are shown in Fig. 1. Metal pins with obsolete threads may sometimes be bushed with lead and thus rendered serviceable where otherwise they must be scrapped.

All-wood pins are of little service when deteriorated, although the shanks may be used as the pin-hole plugs for three-pin service buck-arms as previously mentioned.

One use of obsolete small cross-arm braces was mentioned in connection with these buck-arms. Other applications will be found in connection with special construction work, particularly around substations.

Light space bolts and through bolts, usually ½ in. (1.27 cm.) where ⅝ in. (1.59 cm.) are now standard, will of course be found of service in construction around any plant. There are also a few special uses to which these may be put in connection with line work. Where angle-iron braces are used with large-size cross-arms, two ½-in. (1.27-cm.) bolts are required with each brace, and these may be made up from old through bolts which have been shortened. The threaded end of a cut-off space bolt may be used as a stud with that type of pin which consists of a malleable-iron top and a separable stud bolt. Such studs with two nuts (one battered on) make good short bolts for attaching strain insulators to universal dead-ending clevises or similar devices. It is interesting to note that one of the few

advantages which cut-thread have over rolled-thread bolts is in their use as second-hand material, the cut thread permitting modification for other uses better.

Pole steps are not installed by power companies these days to such an extent as formerly. At one time all poles were stepped. Now it is usually the custom to step only transformer, switch and arc-lamp poles and sometimes not even these. Consequently most companies accumulate a considerable stock of second-hand pole steps. On account of the hook shape they have many useful purposes in miscellaneous work. They can be employed as spikes for industrial railways, as tent stakes, as cable racks in manholes, and as form hooks and anchors for future extensions in concrete work. They are useful about a warehouse as hooks for tools and ropes. A few may be used inverted as hooks to hold the ring at the lower end of arc-lamp chains or ropes where reels are not used. Occasionally they may serve as lag screws. The communication companies are still faithful to pole steps, and they should not be overlooked as a possible outlet for the surplus.

Many forms of metal scrap are useful as reinforcing in concrete. If concrete anchor slugs are used, old bolts, pole steps and braces will make excellent reinforcing. Short pieces of guy cable, whether new or retired, are also useful as reinforcing in any concrete building work. There is always a considerable waste in guying a line unless the men are careful in cutting to length and use short ends between the pole and the strain insulator. Where steel conductors are used short pieces of guy cable are unraveled for ties.

Brackets of old types can usually be disposed of in special service work. In these days of military camps wood brackets are useful for distribution systems among the tents. One company wiring a large camp used up a year's accumulation stringing secondaries bracketed on short square poles between tent groups and to latrines and messhouses.

Inclosed carbon arcs are giving way to gas-filled tungsten-filament units. The retired arcs may often be employed with slight modifications to house the incandescent lamps. Arc-lamp coils, whether series or shunt, are very useful around repair shops or laboratories and in the manufacture of home-made relays, switch mechanisms, etc. Therefore a number should be saved when lamps are scrapped. Arc-lamp carbons of obsolete size may be set up in groups and used as rheostats. A few old arc reels will be found serviceable around any plant as light hoists. Old shades, whether glass or steel, may be employed as reflectors with incandescent lamps. Clear-glass globes of the closed type can be sold to furniture stores for fish globes. Arc-lamp chains in long or short pieces will be found to serve many useful purposes. They are handy in threading through vertical runs of conduit. Short lengths will serve as pipe or conduit hangers under buildings. A secondary dead-end of the strain type, readily attachable to the end of any space or through-bolt and having all metal parts galvanized, may be cheaply made up with a porcelain strain insulator, a short piece of arc chain, a lap link and a dead-ending clevis (Fig. 2).

DISPOSING OF OTHER MATERIALS

Transformers and meters when retired are generally returned to the manufacturers for credit on new goods. When this is not done some parts may be saved from the scrap pile to advantage. Transformer cases with leads intact make excellent waterproof cases for the installation of meters, instrument transformers or relays in the open. Occasionally a transformer case is needed in camouflaging a check meter on the service of a suspected customer, and a small quantity of transformer laminations are always of use about a shop and should be saved out of the scrap heap. The same is true of coils with the insulation burned off, if the wire is not damaged, as a quantity of binding wire is needed about any shop or test room for connections, etc.

Linemen's gloves after breakdown on test are useful where acids or other corrosive substances are employed, as for instance in handling materials in the lye solution in gas-meter shops, packing plants, etc.

The disposition of short lengths of lead-covered cable is always a problem. These accumulate with startling rapidity, even when every effort is made to utilize the shortest length in stock on each new installation. When cable is scrapped it generally pays to strip the lead. When flattened out this is useful for packing, washers, pipe saddles, etc. When these are not needed the sheath can be melted into solder or pin thimbles.

Packing material should be conserved in the same manner as supplies. Sacks are useful in putting up orders for local line crews, and boxes, barrels and crates should be available for goods sent to district storerooms. Heavy lumber from large crates should be saved for pole-hole covers. Barrels are often necessary when holes are to be dug in sandy or marshy ground.

It is advisable to provide a special workbench for the renovation of discarded line material and to keep at least one storeroom employee continuously at this work, so that he may become expert in decisions upon the utility and proper disposal of the various devices retired. In any case the foremen of the plant blacksmith, machine and carpenter shops, who ordinarily do not come into close contact with the line department, should be made familiar with overstock and obsolete materials, such as braces, bolts and lag screws. A knowledge on the part of these men of what is available will frequently save time and expense by permitting the substitution of second-hand line hardware for new stock in various routine repair and construction jobs.

It is hoped that this discussion will lead engineers to contribute ideas on how other economies can be effected.

Plan Coal-Saving Campaign Among Industrial Consumers

A nation-wide campaign for economy in the use of coal among steam plants will be undertaken by the United States Fuel Administration. The campaign was determined upon following a conference of representatives of the Fuel Administration, the Bureau of Mines and the American Society of Mechanical Engineers. The intention is to provide for an inspection of steam plants and practical demonstrations in scientific firing that will afford higher efficiency and smaller consumption of coal. The educational campaign planned will be conducted by the Bureau of Mines, with the full backing of the Fuel Administration.

Public Steam and Electrical Systems

An Analysis of the Building Heating Situation in Large Cities, Made with Reference to the Distribution of Power from Central Stations—Comparative Tables of Steam and Electric Heat

BY J. A. M'HOLLAN

Vice-President of the Martin-McHollan Company

COMPARED with the remarkable expansion which has taken place within recent years in the public systems of electrical supply, the development of public systems of steam distribution has been practically at a standstill. Such extensions as have taken place have been confined chiefly to cities of moderate size or to territories where the buildings served are of the smaller or residential class. Yet a public system of steam distribution has manifest advantages for the business districts of a large city, and the purchase of steam would be generally adopted by manufacturers and building operators if the service was provided at reasonable rates. As a companion service to that provided by the electrical corporations a public system of steam supply presents many features of advantage, but before such a development can receive serious consideration from the electrical interests it must be shown not only that the steam can be produced, distributed and disposed of at rates sufficiently low to secure the business, but that the sale of steam to such buildings will also promote the purchase of the electric service.

The striking success which has attended the operation of electric companies in the great cities of America has no direct bearing on the practicability of a public system of steam supply. There is a fundamental difference between the conditions that govern the production, distribution and sale of steam as compared with electricity, and the advantages are almost entirely on the side of the electrical industry.

A forceful illustration of the difference between steam and electric systems is furnished by the percentage of operating costs in large central stations given in Table I.

TABLE I—COMPARISON OF STEAM AND ELECTRIC PRODUCTION COSTS IN CENTRAL STATIONS

	Steam Costs			Electric Costs		
	Cents per 1000 Lb.	Per Cent of Net Production Cost	Per Cent of Sale Price at 45 Cents per 1000 Lb.	Cents per Kw.-hr.	Per Cent of Net Production Cost	Per Cent of Sale Price at 3 Cents per Kw.-hr.
Labor	2.6	10.5	5.8	0.08	17.3	2.7
Fuel	17.5	71.5	38.8	0.3	65.2	10.0
Ash removal	0.7	2.8	1.5	0.01	2.2	0.3
Water	1.9	7.8	4.2	0.004	0.9	0.1
Upkeep, repairs and supplies	1.8	7.4	4.1	0.066	14.4	2.2
Cost at station	24.5	100	54.4	0.46	100	15.3

These figures are based on fuel prices prevailing before the war and would vary according to locality. In the event of fuel costs being doubled, as actually happened this year, the cost of steam at the station is increased by 39 per cent of the assumed sale price of 45 cents per 1000 lb., while that of electricity is increased by 10 per cent of the assumed sale price of 3 cents per kilowatt-hour. In a steam system an increase in the cost of fuel is of prime importance. In an electrical system it affects the margin of profit to only a moderate extent. The sale prices assumed for steam and electricity in the above comparison are arbitrary, except in the sense that each price may be regarded as a wholesale rate on a large quantity used. The comparison may be applied on the basis of retail prices with similar results.

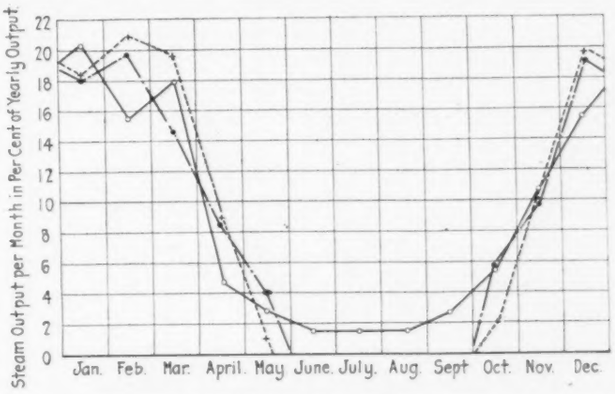


FIG. 1—MONTHLY VARIATIONS AND STEAM OUTPUT IN OFFICE BUILDINGS WHERE ELECTRICITY IS PURCHASED

The opinion is generally held by engineers that inasmuch as each system deals with the production and distribution of energy, and as steam is required in many large buildings for purposes which cannot at the present time be served economically by electricity, there are substantial advantages in having both systems under one control so as to avoid wasteful competition and unnecessary duplication of equipment. A few years ago such a view would probably have been correct, but a review of steam and electrical development up to the present day will serve to show that the field for electrical application in the large commercial buildings is as steadily increasing as that for steam is decreasing.

This is well illustrated by the figures given in Table II for two large office buildings in New York City.

Perhaps the most important factor in determining the future of steam companies in the larger cities of America will be the outcome of the controversy over the economy of operating private electrical power plants as compared with purchasing the electricity from outside sources. The extent to which the operation of these power plants is likely to be displaced by the purchase of the electricity has a most important bearing on the future of steam supply companies. When a private electrical power plant is operated to produce electric energy the effect is to maintain a high monthly

load factor, and when the electric service is purchased from outside sources there is a marked decrease during at least one-half of the year in the total amount of steam used. In the more modern buildings it now is an established policy to purchase the electric energy, and the other machinery is usually selected so that no steam-using machinery has to be operated in the summer season. The monthly variations of the steam usages in three large office buildings are shown in Diagram I. In two of these steam is used only during the winter season, no steam being required in the summer months of the year. Diagrams II and III show the steam requirements in several types of modern buildings where private plants have been shut down.

TABLE II—USAGES OF STEAM AND ELECTRICITY IN OFFICE BUILDINGS

	Old Office Building	New Office Building
Volume	3,200,000 cu. ft.	6,500,000 cu. ft.
Total steam used per year	78,400,000 lb.	25,200,000 lb.
Total electricity used per year	*700,000 kw.-hr.	950,000 kw.-hr.

*High electrical consumption due to design of building—interior corridors, insufficient window surface for natural lighting.

Old Office Building			New Office Building	
Services	Method of Production or Operation	Per Cent of Total Steam Used	Method of Production or Operation	Per Cent of Total Steam Used
General power and lighting	Steam*	45	Purchased electricity	..
House heating	Steam	27	Steam	93
Water heating	Steam	3	Steam	7
Elevator service	Steam	18	Purchased electricity	..
Water pumping	Steam	3	Purchased electricity	..
Auxiliary pump operation	Steam	4	Purchased electricity	..

*To produce electricity.

In buildings where machinery is operated to produce electric energy the monthly output of steam is more constant. A high rate of usage is maintained over the summer season and the load is of a character that would be a desirable addition to a steam supply company. Load curves of various classes of buildings are shown in Diagrams IV and V. A brief study of these will serve to show that a steam company can derive its most desirable business, not in new buildings, but in existing buildings where the elevators and pumping services are steam-operated, and particularly in those where the electric service is produced by means of private power plants.

The purchase of electric service in large commercial buildings divides itself into two distinct and separate subdivisions:

(1) In new buildings where the purchase of the electric service is considered at the time of the erection of the building.

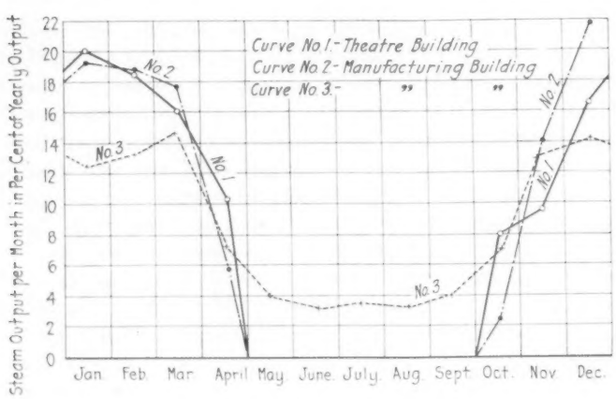
(2) In existing buildings where private power plant machinery is already provided and in operation.

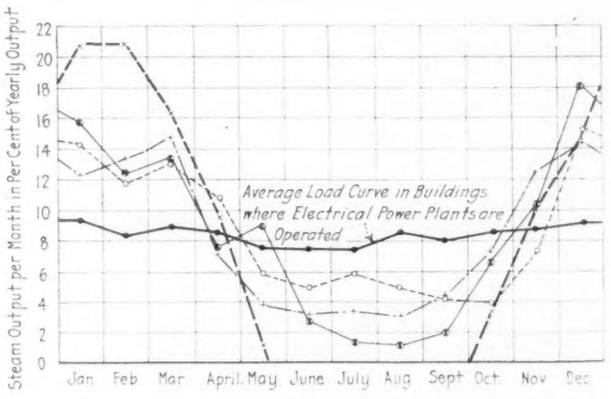
In existing buildings where private power plants have already been installed and are maintained in operation the situation is less favorable to the central station. In the older buildings, where the machinery is provided, the operation of the power plant is more or less a fixed feature and likely to be disturbed when a failure in operation occurs, when extensions or alterations become necessary, or when electric rates are reduced.

Perhaps the greatest obstacle to the extension of the central-station service to such structures is the uncertainty that surrounds the cost of operating the steam services other than the production of electricity. When electric service is purchased it is always necessary to continue operating certain high-pressure steam services.

The electrical corporations are in a most peculiar situation. To secure business which would increase their load factor and would ultimately enable them to effect a general reduction in rates both to large and small consumers, they must step out of their particular field of supplying electric energy and must guarantee or satisfy prospective large customers, in some way or other, as to the cost of the steam services which are left to be provided when the electricity is purchased. The cost of the steam services is almost invariably higher than the cost of the purchased electricity, although this fact is not generally appreciated. The general proportion in buildings where electricity is purchased is as follows: Cost of purchased electricity, 30 per cent of total annual costs; cost of high-pressure steam services and heating (inclusive of fuel, labor, ash removal, supplies and repairs, labor insurance, supplies and repairs to machinery), 70 per cent.

It is to be noted that the items which make up the cost of the steam services are flexible and subject to increase or decrease proportionately with the care and


Curve No. 1 - Theatre Building
Curve No. 2 - Manufacturing Building
Curve No. 3 - " "
No. 2
No. 3
No. 1
Steam Output per Month in Per Cent of Yearly Output
Jan. Feb. Mar. April May June July Aug. Sept Oct. Nov. Dec.


Average Load Curve in Buildings where Electrical Power Plants are Operated
Steam Output per Month in Per Cent of Yearly Output
Jan. Feb. Mar. April May June July Aug. Sept Oct. Nov. Dec.

FIGS. 2 AND 3—MONTHLY VARIATIONS IN STEAM OUTPUT IN BUILDINGS WHERE ELECTRIC POWER PLANTS HAVE BEEN DISCONTINUED

intelligence with which the equipment is operated, and it is clearly to the interests of an electrical corporation to see that they are provided at the minimum cost.

The tendency of the present age in the large cities of America is towards electrification, and the steady expansion in this direction is a menace to the future of the steam supply business. Elevators can be more

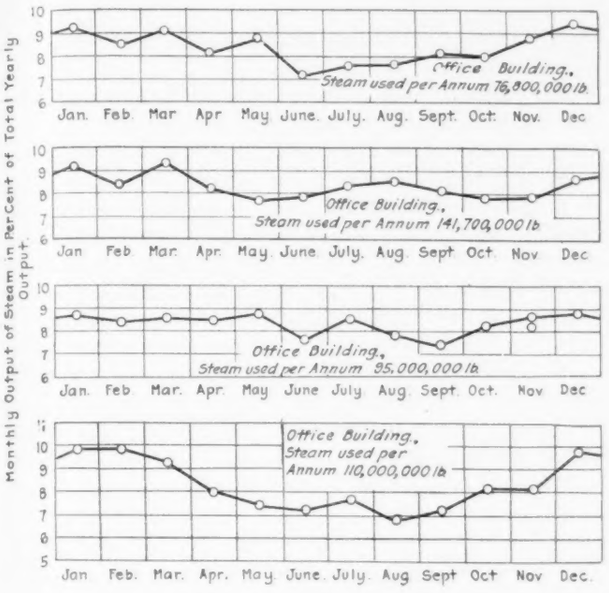

Monthly Output of Steam in Per Cent of Total Yearly Output.
Office Building., Steam used per Annum 76,800,000 lb.
Office Building., Steam used per Annum 141,700,000 lb.
Office Building., Steam used per Annum 95,000,000 lb.
Office Building., Steam used per Annum 110,000,000 lb.
Jan. Feb. Mar. Apr. May. June. July. Aug. Sept. Oct. Nov. Dec.

FIG. 4—MONTHLY VARIATIONS IN STEAM OUTPUT IN OFFICE BUILDINGS WITH PRIVATE POWER PLANTS IN OPERATION

economically and more effectively operated by electricity than by steam-produced hydraulic power. Pumping, not only of water, but of sewage, can be economically provided by electric energy. Refrigeration lends itself to the use of electricity, and it is almost certain that the public steam systems must find their future business largely in the heating of buildings. They will have to meet a problem of transacting a profitable business with equipment which may have to remain disused over one-half of the year, and the significant fact must not be lost sight of that the use of exhaust steam has not thus far been found practicable in central-station heating systems. The enormous expense of installing the large mains when exhaust steam is required and the necessity of maintaining a high pressure throughout the system has led to the general use of piping systems supplied with high-pressure steam. If the electrical corporations can completely displace the operation of private power plants, there is left for the steam company only the heating business, extending over the winter months and of a variable character that does not lend itself to a profitable use of the equipment.

The question arises whether the use of steam for heating may be displaced by gas or electricity or other heating agent. Steam is superior to gas in that the air in the space heated is not polluted by the gases of combustion. Electrical heating, on the other hand, is superior both to gas and steam, but cannot be used on account of the excessive cost. A series of interesting experiments conducted by J. D. Ross, superintendent of the Seattle municipal plant, discloses that electrical heating is comparable to steam with coal at $6 per ton and electricity at 0.4 cent per kilowatt-hour. In connection with this question of electrical heating it may be of interest to consider the magnitude of the problem of heating a large building by means of electricity. An interesting example is available in the group of institutional buildings in New York City upon which observations were made on the power, lighting and heating services over an entire year. The usages for light and power in this group of buildings amounted during the year of the test to approximately 712,000 kw.-hr. In this, as in most other tall buildings, the heating of the building is only one of the services that are steam-operated. The elevators are driven by steam pumps; the house water, refrigeration and auxiliary engine-room services are provided by means of steam-using apparatus. If these appliances were rearranged so as to be electrically operated, the increase in the electrical usages would be approximately doubled, or a total usage, without the heating of the building or the hot-water supply, of 1,500,000 kw.-hr. The heating of the buildings absorbed 30,000,000,000 heat units and the heating of the water supply absorbed 2,000,000,000 heat units. Of these amounts perhaps about 20 per cent was used in the form of piping losses and other wastages, leaving a net total of about 26,000,000,000 to be provided electrically, which at 100 per cent efficiency in electrical heaters would correspond to a total usage of energy for heating purposes of about 8,000,000 kw.-hr., or about eleven times the consumption under test conditions with only the power and lighting services provided by means of electricity. In the case of a twelve-story hotel the electric energy required for heating would be about 2,500,000 kw.-hr., or fifteen times the usage of electricity for power and lighting purposes. These totals are for individual buildings and serve to show the magnitude of the prob-

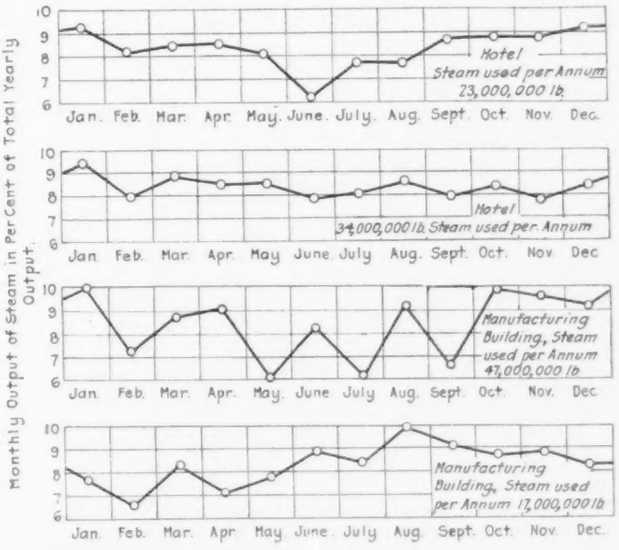

Monthly Output of Steam in Per Cent of Total Yearly Output.
Hotel Steam used per Annum 23,000,000 lb.
Hotel 34,000,000 lb. Steam used per Annum
Manufacturing Building, Steam used per Annum 47,000,000 lb.
Manufacturing Building, Steam used per Annum 17,000,000 lb.
Jan. Feb. Mar. Apr. May. June. July. Aug. Sept. Oct. Nov. Dec.

FIG. 5—MONTHLY VARIATIONS IN STEAM OUTPUT IN FACTORIES AND HOTELS WITH PRIVATE POWER PLANTS IN OPERATION

lem of electrical heating in large buildings. It is impossible to predict future developments in the electrical industry, but if an increasing price of fuel and a decreasing rate for electric service should force electrical heating to be considered as an economic development it can readily be seen that not only will costly and radical changes be required in the underground electrical systems in our large cities, but the present huge power stations will be totally inadequate to meet requirements.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

FEATURES OF CHICAGO'S NEW PARKWAY LIGHTING SYSTEM

Details of Construction, Including Method of Running Circuits and Use of Series-Multiple Transformers with Special Couplings

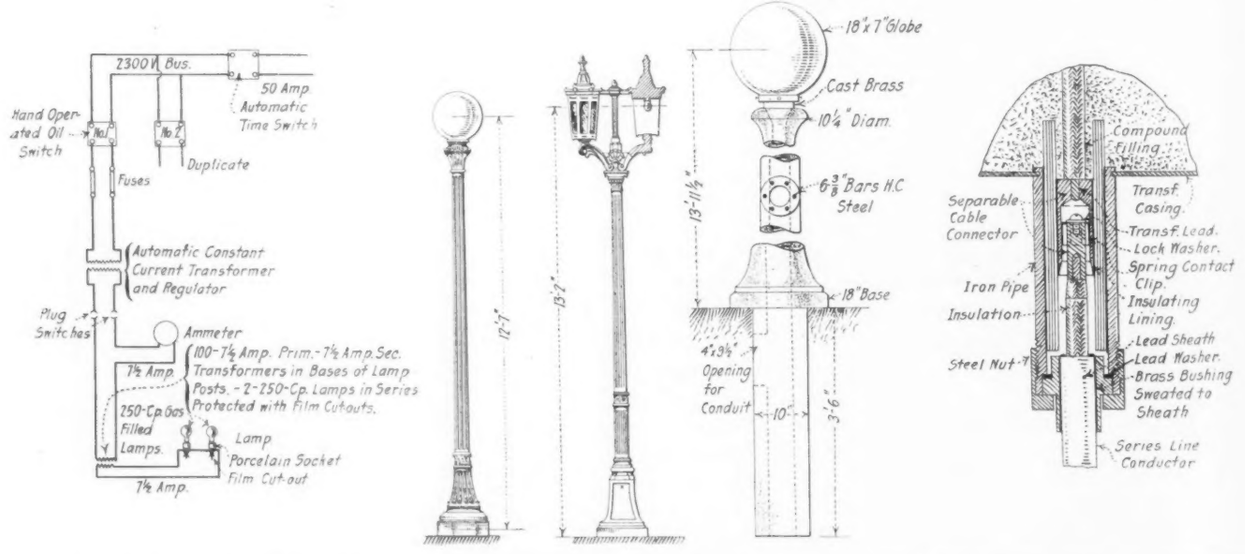
Several unusual engineering features are included in the three additions to the extensive boulevard and parkway lighting system now being completed by the South Park Commission in Chicago.

The typical parkway block contains four lamps between street intersections. In so far as possible the existing 5000-volt cable will be used, since it has been determined that the rubber insulation, although some of it has been in service since the World's Fair of 1893, is as good as can be purchased to-day. The adoption of this plan made it possible to purchase 50 per cent less cable than would otherwise have been necessary. All circuits will be laid in 3-in. (7.6-cm.) fiber conduit in the grass plot.

The standards and lanterns, which were selected for their artistic design, stand 13 ft. 2 in. (4 m.) high to the lamp center and are bolted to a concrete base. The lantern faces are fitted with "Synite" glass to diffuse each. The standards which these units will replace are of the old World's Fair type.

The primary leads of each series-multiple transformer will be equipped with detachable couplings. This feature, in addition to eliminating the slow and expensive construction involved in using wiped joints, also makes it possible to disconnect any lamp-post transformer readily. This is of value in testing and changing transformers. The details of the disconnecting feature are shown in Fig. 5. The estimated cost of this part of the system will be about $57,000, or $178 per standard.

In the 0.5-mile (0.8-km.) stretch of Garfield Boulevard which will be relighted 124 single-lamp standards will be set. These units will be placed four abreast on two parallel drives separated by a grass plot and will utilize circuits laid to serve eighteen old 1000-watt lamps on World's Fair standards. The new units will be mounted on the Universal Concrete Products Company concrete posts set about 80 ft. (24.4 m.) apart. The posts will be set in concrete and will be of such height that the light center will be 10 ft. 6 in. (3.2 m.) above the street. In order to take the fullest advantage of the existing cable and at the same time to give as much light as possible to the merchants who are



FIGS. 1, 2, 3, 4 AND 5—CIRCUITS FOR SUPPLYING DOUBLE-LANTERN STANDARDS; UNIT FOR RESIDENTIAL STREETS; MICHIGAN BOULEVARD STANDARD; CONCRETE STANDARD FOR WHITE-WAY LIGHTING; DISCONNECTING FEATURES FOR PRIMARY LEADS OF SERIES-MULTIPLE TRANSFORMER

the light from the 250-cp. gas-filled tungsten lamp which each will contain. The two lamps on each standard will be operated in series from a 7.5-amp. circuit connected to a series-multiple transformer in the base of the post. Low-voltage film cut-outs of special design will prevent the complete failure of a unit through the failure of a single lamp. According to reports these lighting standards, which cost $40 each when the contracts were let two years ago, could not be duplicated now for $80 helping pay for this 0.5-mile (0.8-km.) stretch, larger lamps will be used in those units on the property sides than in those on the boulevard planting space. It is probable that the property-side lamps will be rated at 250 cp. and the others at 100 cp. Alba diffusing globes will be used throughout. The total estimated cost of this lighting, which is of the straight-series type, will be about $15,000, of which the merchants will pay one-third. This makes the cost per post about $120.

PREVENTING INSTALLATION OF WRONG-SIZED FUSES

Two Types of Stickers Printed in Red Ink Are Used to Caution Unskilled Workmen Regarding the Sizes of Fuses to Use

Safety stickers pasted on fuse cabinets by the Oklahoma Inspection Bureau serve a twofold purpose. They are a precaution against the use of wrong-sized fuses, and they emphasize the fact that it is danger-

FOR SAFETY
USE ONLY
10 AMP. FUSES
OKLA INSPECTION BUREAU
CAUTION!
DO NOT STAND IN DAMP PLACE OR TOUCH ANY GROUNDED METAL OR CONDUIT WHILE TOUCHING METAL SOCKETS OR LIVE WIRES.
KEEP CABINET BOX CLOSED
OKLAHOMA INSPECTION BUREAU

SAMPLES OF STICKERS PASTED ON FUSE CABINET BOXES TO GIVE EVIDENCE OF PREVIOUS INSPECTION

ous to let the body become the connecting link between live wires and a good ground. When the fuse sticker is pasted in the cabinet box and an inspector later discovers the wrong fuse in use he has tangible evidence that previous warning had been given and can act accordingly. H. J. Clark of the inspection bureau reports that the stickers are very effective.

METHOD OF TRANSPORTING LARGE POWER TRANSFORMERS

Core Packed and Case Crated So that the Entire Unit Could Be Shipped Lying Down—Skidding and Upraising Transformer

In shipping three 7500-kva. water-cooled transformers to the Northern States Power Company, St. Paul, Minn., the Westinghouse Electric & Manufacturing Company adopted a novel method of skidding and packing the transformers which might be used to advantage anywhere for transporting extra-heavy transformers where head room is limited. The units were so large that if shipped in the upright position on a drop-frame car they would have barely been within the maximum height permitted by structures over the railroads, etc. To avoid this difficulty a cradle was made for each transformer, in which it could be laid on one side.

The cradle consisted of three skids with heavy timber cross-pieces shaped to receive the curved case and a framework at right angles to one end of the skids. The parts were firmly fastened together and those at right angles braced by tie rods. The transformer case was laid in this cradle with its base against the vertical end of the cradle and held in place with straps and tie rods running through the skids. The ends of the skids under the vertical frame were cut diagonally to permit rocking the case into an upright position.

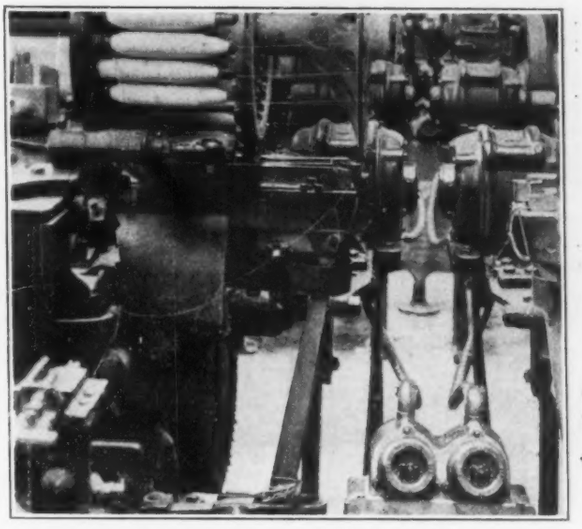
To prevent injury of the transformer windings, wood slats were fastened around the core so it would fit the case snugly. The cooling coils were left fastened to the transformer cover and a bracing was provided through the center of the coils to the top of the cover. The latter in turn was braced against the end of the car, thus serving to hold the transformer in place inside the tank.

In handling the cradle equal-length chains were attached to the top of the cradle side and the end of the skids under the top of the transformer so that when lifted by a crane each one would share the weight. To tilt the transformer into an upright position the chain fastened near the head of the transformer was raised while the other was let out. In this way rough jostling was avoided.

MOUNTING LOOM-MOTOR SWITCHES IN PAIRS

Handles Are Recessed in Disks and Short Connections by Means of Conduit Are Made to the Motors

Heavy duty switches for use on loom motors are now mounted in pairs on a single fuse box in some of the latest installations, as shown in the accompanying photograph. In a weave shed where hundreds of looms are in service and tended by young girls with no electrical or mechanical training simplicity of control, combined with entire safety of operation, is of vital importance, particularly where the motors are wound for 220 volts and upward. In the installation shown the looms are mounted with ends reversed, and the adjacent motors are thus brought within 2 in. or 3 in. (5 cm. or 7.6 cm.) of each other. Near the floor the intervening space is occupied by the pedestal, fuse box and switch pair shown.



HEAVY-DUTY SWITCHES FOR LOOM MOTORS

Each switch is of the most rugged type, capable of withstanding much abuse. The handles are recessed in disks marked for "off" and "on" positions, and short connections are run to the motors with BX conduit. Nothing short of deliberate destruction is likely to affect the operation of these units. It is feasible by staggering the loom motors with respect to the inter-

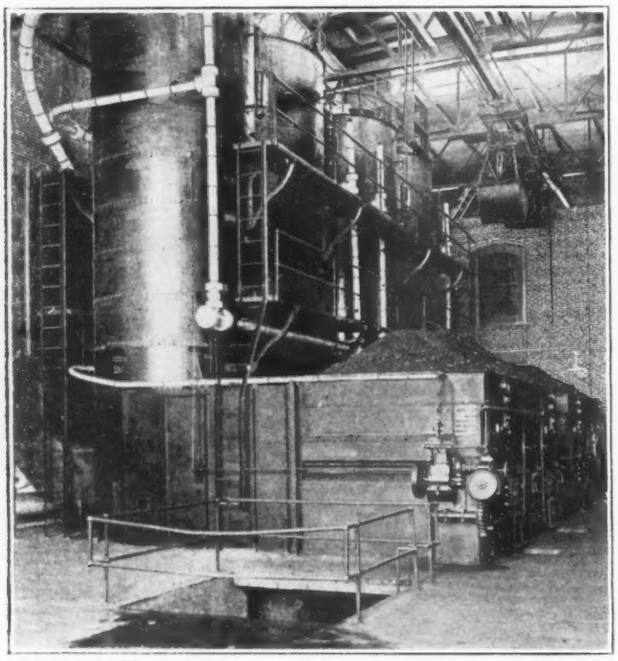
mediate aisle to provide for a quicker inspection than would be possible with a purely symmetrical arrangement. The space between loom ends is of insufficient value to justify reserving it for the passage of the operator or inspector, and the economy in wiring secured by double switch mounting close to the loom motors is considerable in a large installation.

The view shown was taken in the mills of the Naumkeag Steam Cotton Company, one of the largest customers of the Salem (Mass.) Electric Lighting Company, and the heavy-duty switches and motors are of General Electric make.

HANDLING COAL AND ASHES WITH A SINGLE HOIST

Quick and Flexible Means of Handling Coal and Ashes Was Obtained at Moderate Cost—Advantages of This Method

Handling both coal and ashes by a single monorail electric hoist avoids the use of costly and more elaborate equipment at the boiler plant of the Dennison Manufacturing Company, Framingham, Mass. Coal is brought to the station storage yard outside the plant by rail and is reclaimed by a ¾-ton Sprague hoist, which delivers it by gravity to the hoppers of the stokers. These are of the Murphy type, the furnaces being of the extended Dutch-oven design. Ashes are discharged through chutes at the bottom of the ash pits to an industrial car in the basement, and thence discharged



OPENING THROUGH WHICH ASHES ARE REMOVED SHOWN IN FOREGROUND

into a pit. From this they are elevated through an opening in the boiler-room floor by the grab bucket on the monorail hoist and carried away for disposal outside the building.

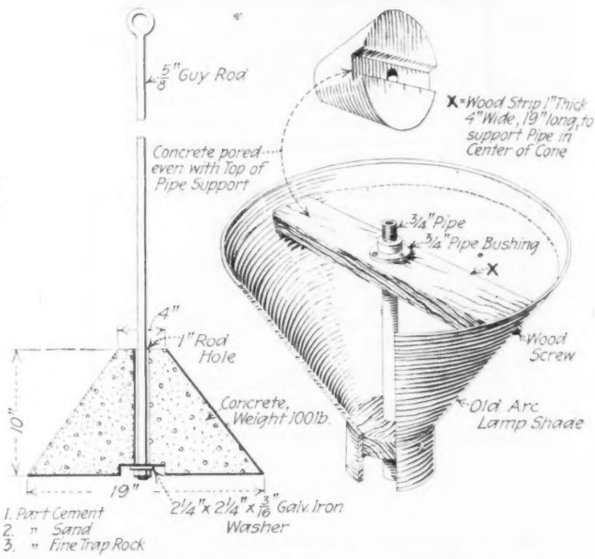
At moderate first cost a quick and flexible means of handling coal and ashes is thus provided. The boiler room is unusually free from overhead obstructions, and the equipment can be shut down at intervals.

CONE-SHAPED GUY ANCHOR THAT IS EASILY MADE

Sheet-Iron Forms Made from Old Arc-Lamp Hoods Are Used—Concrete Proportions and the Dimensions of the Anchor

BY M. N. LONGBOTHUM

The accompanying illustration shows a concrete guy anchor used by the Winsted (Conn.) Gas Company which is proving satisfactory. The anchor is made of concrete mixed in proportions of one part cement, two



DETAILS OF CONCRETE ANCHOR AND SHEET-IRON MOLD

parts sand and three parts crushed stone that pass a ¾-in. (19-mm.) mesh screen. The anchors weigh about 100 lb. (45.4 kg.) each. About three pails of concrete are used to fill the sheet-iron forms, which were made from old arc-lamp hoods. The anchor is cone-shaped, 19 in. (48.3 cm.) over the base or largest diameter, with a 1-in. (2.54-cm.) hole through the center for the insertion of a ⅝-in. or ¾-in. (1.6 cm. or 1.9-cm.) guy rod.

UNIFORM FUEL BED ESSENTIAL FOR ECONOMY

Unintelligent Use of Slice Bars and Pokers for Purpose of Keeping Up Pressure Brings About Poor Results

A fuel bed that is not of uniform thickness, condition and porosity cannot be productive of the highest efficiency. The condition of the fuel bed is often made worse by the excessive and unintelligent use of slice bars and pokers for the purpose of keeping up steam pressure. This results in several losses: (a) It makes the fuel bed uneven in thickness or distribution, causing holes, with resultant loss due to excessive air; (b) stirring up the fuel bed generally causes much smoke and soot, which lowers the heat-absorbing capacity of the plant by forming a coating on the boiler and economizer heating surfaces and results in a greater heat loss in the flue gases; (c) stirring up the half-consumed coal and coke brings the ash to the top of the fuel bed, where it fuses and runs together, making clinkers. This action renders part of the grate surface ineffective by closing off the passage of air.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

COST OF OPERATION OF CLUB ELECTRIC GRILL

Figures on Energy Consumption and Repair Cost at New York Engineers' Club for Period of One Year

Figures kept for one year on the cost of operation of the Buzzini electric grill at the Engineers' Club, New York City, show a weekly expense of $11.02 for six grills with energy at 1 cent per kilowatt-hour, or less than $2 per week per grill. The figures are as follows:

Number of grills	6
Grill renewals per year	12
Current, amp.	17.5
Voltage	240
Grill hours per week	245
Kilowatt-hours per week	1,029
Kilowatt-hours per annum	53,508
	Per Year
Cost of wire	$25.00
Cost of wire coiling	2.50
Cost of millboard	1.00
Cost of labor	9.32
Total cost of renewals	$37.82
Cost of operation per week for six grills:	
Energy, at 1 cent	$10.29
Repairs, $37.82÷52	0.73
Total cost	$11.02
Total cost per annum	$573.00

RANGE SALES SITUATION IN THE COMING YEAR

Evidence Points to a Curtailment of the Free-Time and Installment Plans Formerly Followed by Central Stations

Individual opinions of central-station sales managers on the electric range business in 1918 have been solicited by the ELECTRICAL WORLD. How the outlook appears to these men, some of whom are members of the electric range committee of the National Electric Light Association, may be summarized as follows: First, the sale of electric ranges will not be discontinued; second, there has already been established a certain amount of consumer demand for ranges; third, the methods of selling electric ranges will be changed, particularly in that it will be found difficult by the utilities to finance installations through long periods of free trials and installments to the extent formerly practiced.

A summary of the general situation by C. E. Michel, acting sales manager of the Union Electric Light & Power Company and chairman of the electric range committee of the N. E. L. A., is given in this letter:

I have about reached the following conclusions in connection with the range business:

First, the electric range has a very definite place in the economic conditions of to-day. This is particularly true of those communities in which coal can either not be secured at all or where, if secured, the price is so high that it is impossible to use it in the inefficient coal cooking range.

Second, other places in which electric range activity is clearly indicated are those sections of the country where natural gas is beginning to fail or has already failed and where electricity is available at a reasonable price.

Third, an important field is open in those sections where generating and line capacity is available and an intensified use of available circuits is desirable.

In the large central stations where intensive selling campaigns have been going on for the last two or three years I look for certain well-defined and carefully thought-out retrenchments. I do not believe that as a whole the central-station industry will continue to finance this business as it has in the past. It is quite possible, however, that this will have a wholesome effect on the business in general, as the objectionable trial feature which a great many of us have felt necessary in the introduction of the article will be sharply restricted and customers will be educated to pay a legitimate price for the range and its installation.

We are entering upon a difficult period of business life, and when we come out of the war a great many things will have a different aspect from that of to-day. Customs will probably be different, and readjustments will have to be made. The range manufacturer must be alert and awake to see that he shall find his proper place in the new arrangement of things. That this place will exist seems absolutely certain to me.

For the immediate future I see a sharp restriction in one fertile field, the apartment house, as, from the standpoint of both labor and material, the cost of apartment-house construction is to-day almost prohibitive. Buildings of a kind in which the electric range man is interested are not generally being constructed; there are a few notable exceptions to this, of course, but the statement as a whole is true. On the other hand, the field not affected by the slackness of building is so enormous and virgin in its nature that there should be a substantial sale of electric ranges.

Another prominent central-station sales manager, whose success with range selling is recognized, after stating that central stations would probably not push range sales this year on account of the prices of coal, capital and line materials, said:

In spite, however, of the above-mentioned factors, I think the demand for electric ranges is greater than ever, and if past methods could be employed during the coming year, I feel certain the sales would far surpass those accomplished in past years. Also past efforts have resulted in many central stations getting a considerable number of ranges on their lines, and this has served to educate the public to a large extent and is gradually creating a very healthy demand.

The fact that it has become almost universal practice in the sale of household equipment to sell it on the installment plan of course makes it difficult to sell ranges in quantities for cash and at list prices, as people have been educated to purchase all such household equipment on the installment plan. Moreover, the facts that the price of the electric range is about four times that of a gas range of similar style and size and that the customer can purchase a gas range on the installment plan will be factors working against sales in large quantities.

I dare say central stations will, however, be able to find enough customers who can pay cash and pay full price, and who live where the central station has the line capacity to care for the range without additional investment, to make possible a substantial sale of electric ranges. At least, we are finding this to be the case and at the same time have a number of attractive inquiries for range equipment for apartment buildings.

"CASH-AND-CARRY" PLAN APPLIED TO LIGHT BILLS

Instead of Delivering Bills to Customers Small Company Asks Customers to Call for Them and in This Way Reduce Expense

Lighting companies operating in small communities have been under a greater comparative strain during the past two years than those operating in larger places. With little opportunity to increase their load, with fixed rates and the increasing cost of operation, these small companies, which never did as a class enjoy an enviable net profit, have been hard pushed these days to show any profit at all. To prevent disaster economies must be put into practice wherever possible. A single example of an economical measure particularly adaptable to the small-town property is outlined below. It is a method for cutting the cost of billing.

Electric Light and Power Bills

Will be ready for distribution at the Company's office

January 1st

We are discontinuing the old practice of delivering bills, and will be pleased to have you co-operate with us by calling for your bill promptly.

Respectfully,

Fayette County Utilities Co.

ADVERTISEMENT USED TO ANNOUNCE CHANGE IN BILLING METHOD

Several subsidiaries of the Utilities Development Corporation of Chicago have discontinued their old practice of distributing or mailing bills for electric service to consumers. Instead they now advertise that the bills are ready for distribution at the company's office and request customers to call for them. The companies which have tried the plan, according to Miss L. M. Beefield of the Utilities Development Corporation, are enthusiastic over its success.

The Fayette County Utilities Company, Oelwein, Iowa, one of the subsidiaries using the plan, reports that in November the expense of sending out the bills was approximately $18.65 under the former method, and this represented the situation generally throughout the industry. This figure included payment of 1 cent per bill to the high-school boy who delivered the majority of the bills, besides the cost of envelopes, labor of folding, inclosing, sealing and stamping the remainder, plus postage. In December, under the new system, the expense was only $7.50, namely $2 for the advertisement and $5 for postage on the bills which were not called for, plus about 50 cents for the envelopes. Seventy-five per cent of the bills were called for by Jan. 15 after the advertisement was printed making the announcement as of Jan. 1. A far greater proportion of bills called for is expected in succeeding months, inasmuch as many customers failed to notice the advertisement and were awaiting the receipt of their bills by carrier.

In commenting on the plan the Oelwein company stated: "As a labor-saver the plan is a wonder. It does away with the folding and inclosing of the bills, together with the sealing and stamping of envelopes, and we certainly appreciate this extra time along about the latter part of the month!"

In trying out this plan, however, a word of caution is necessary. If a customer does not call for his statement, he should be billed. Otherwise a customer might get two or three months in arrears and find it difficult to make a settlement. In such a case not only does the company stand to take a loss which might wipe out the saving of a whole month but it is also likely to make an enemy.

SPECIAL CARTOON HELPS COMPLAINT DEPARTMENT

Indiana Commercial Department Finds that a Comic Drawing Is of Use in Solving the Problem of the Chronic Kicker

The commercial department of the Indiana Railways & Light Company, Kokomo, Ind., working in close cooperation with the claim department, has used the cartoon reproduced herewith to good advantage during the winter. O. M. Booher, contract agent for the company, speaking about the use of the cartoon, said: "Many hard-boiled kickers on winter lighting bills have been softened considerably by a tactful display of this picture. Of course we did not show it to the general public.

Familiar Fibs
This Light Bill ——— cant be right we used our lights less this month than we did last month and our bill is double, there must be something wrong with our meter ———
Complaint Dep't.

THIS CARTOON HAS HELPED A MIDDLE WEST COMPANY'S CLAIM DEPARTMENT BY APPEALING TO THE "KICKER'S" SENSE OF HUMOR

We picked our men with discretion. I find that if you can touch the funny spot of a man in the proper way, no harm comes from it, and he not only forgets to kick about his light bill but leaves the office a friend of yourself and the company. We used this picture so much during the last winter that we almost wore it out."

POSSIBILITIES IN THE ELECTROCHEMICAL LOAD

Outlook from the Standpoint of the Average Utility Outlined, with a Discussion of the Limiting Features

Considerable interest is being shown by central stations in the possibilities of electrochemical loads. At the recent meeting of the new-business men of the Ohio Electric Light Association C. A. Winder of Niagara Falls discussed the possibility of this load from the standpoint of the average company.

In considering the power consumption, Mr. Winder pointed out that aluminum consumed the largest amount of power per pound of finished product, approximately 12.5 kw.-hr., and is extremely dependent upon the low cost of power. Aluminium manufactories may exist a thousand miles from the center of gravity of distribution provided that power can be obtained at $20 to $25 per kilowatt-year. Artificial abrasives are next, with an energy consumption per pound of product of about half that for aluminum. The weight of finished material, however, is high, bringing the question of freight to the front; so much so, it is said, that if the haul of the finished material were 2000 miles (3218 km.), it is doubtful if an artificial abrasive plant could exist were power free. Under the prevailing price of water power, a 500-mile haul is given as a minimum. Calcium carbide, ferro alloys, sodium, chlorates and phosphorus are stated to be in practically the same position as artificial abrasives, namely, all require power at the prevailing water-power rates and within close proximity to the center of gravity of their consumption.

Ferrosilicon from an engineering standpoint can be made economically under normal circumstances in furnaces of about 10,000-hp. input, and the author states that apparently those companies now entering this field, or contemplating this action, are planning on small furnaces. Such engineering, however, it is pointed out, cannot withstand the rigors of competition that will follow the war, the product now being very high in price. On the other hand, where companies insist upon entering this field to take advantage of the present high prices limited capital requires the installation of small furnaces. An engineering detail in this consideration that has been overlooked is that of frequencies. As a rule, central-station frequency is 60 cycles, but this practically precludes the operation of a ferrosilicon furnace of any size because of poor power factor resulting from high current and high frequency. Low frequency, it was stated, is a prime requisite to the successful operation of ferro-alloy, calcium carbide and similar furnaces. Most of the electric furnace products have been developed at Niagara Falls, where 25 cycles is the prevailing frequency. Even lower frequencies than this are perhaps preferable for electrochemical loads.

Furthermore, it is stated, if we consider off-peak power for such loads as artificial abrasives, ferro-alloys and calcium carbide, it is found that an 80 per cent load factor will so greatly increase the overhead costs that the power would have to be obtained without any cost at all to be attractive. Daily off-peak power for a carborundum furnace is absolutely out of the question, as the carborundum furnace operates for thirty-six hours. Neither, for the same reasons, can the graphite furnace be considered. Valley power coming in periods of eight months is of economic possibilities that are not attractive to the average electrochemical industry.

The smallest user of power per ton output is perhaps the caustic and chlorine industry, and it is consequently the most affected by long freight hauls. Therefore these materials are manufactured near the market and are two of the few electrochemical industries that the central station perhaps may hope to attract. The only difficulty is primarily one of rates.

Summarizing, the author says: "It will be those companies located at the present economic positions and possessing water power, which in itself leads to the reduction of cost, whether it be by virtue of price, quantity or frequency, that will survive this ordeal. The central station may then find itself in a position of having connected load without the ability of the load absorbing its power, and it will take a long time again to build up the load to where it was when the war began. Obviously, the only classes of power users that the modern central station in large cities should solicit are japanning ovens, brass-melting and steel-melting furnaces where good scrap is available and other conditions correct, as well as hundreds of industrial power-consuming devices now being perfected or which have not as yet become commercially applicable but will be perfected under the present war stimulus."

POINTS TO CONSIDER IN CONNECTION WITH PUMPING

Data that the Power Engineer Should Provide the Pump Manufacturer When Seeking a Choice of Pump for Certain Application

R. L. Yates, assistant manager of the Platt Iron Works, Dayton, Ohio, in a paper presented before the industrial heating committee of the Ohio Electric Light Association, discussing pumping from the hydraulic point of view and defining the relation of the central-station power sales engineer to such jobs, included a list of questions the answers to which will acquaint the pump manufacturer with the requirements of any situation where pumps are to be installed. The questions are listed herewith:

1. Number of pumps required.
2. Nature of service.
3. Is vertical or horizontal installation desired?
4. Capacity required in gallons per minute.
5. Total pumping head, including suction, discharge head and friction head.
6. Maximum suction lift, including all friction.
7. Length and size of suction and discharge pipes, giving number and kind of elbows.
8. If pumping head is variable, give maximum variation for both suction and discharge.
9. If pump is below source of supply, will it be submerged or placed in a dry pit?
10. Will pump be required to operate continuously? If not, at what intervals?
11. Nature of liquid to be pumped—hot, clear, fresh, alkaline, cold, gritty, salt, acidulous.
12. If pump is belt-driven, give speed and diameter of pulley.
13. Furnish certified motor-dimension print.
14. Make sketch of proposed pump setting, showing piping.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Armature Reaction in Rotary Converters.—G. BADEY.—Armature reaction in rotary converters is not negligible. It may be classified as of two kinds—fixed and oscillating. The first, expressed in terms of direct-current ampere-turns, affects the performance in the same manner as the attenuated armature reaction of direct-current apparatus. The second should be deadened or attenuated by the proper grouping of the machines. Examples are worked out for (1) a theoretical case of an infinite number of phases and a sinusoidal field; (2) a case of a finite number of phases and a sinusoidal field; (3) the case of a monophase converter.—*Revue Générale de l'Electricité*, Feb. 2, 1918.

Generation, Transmission and Distribution

Electric Waves.—W. S. FRANKLIN and BARRY MCNUTT.—Discussion of the simplest aspects of the dynamics of wave motion. While differential equations are used throughout, mechanical analogies are used extensively to make the explanations intelligible to any one who has studied physics. The discussions may be divided into the following parts among others: Expression of a traveling curve as a partial differential equation; method of handling undetermined constants and functions in the solution of ordinary and partial differential equations respectively; reflection of waves and change of phase caused thereby; differential equations of electric wave motion on a transmission line; effect of traveling distribution of current and voltage; mutually sustaining current and voltage distributions; what determines wave form; transmission-line oscillations which follow switching, etc.—*Journal of Western Society of Engineers*, November, 1917.

Bonus Plan Reduces the Consumption of Coal at Manila.—B. H. BLAISDELL.—By dividing any saving effected with power-plant employees the Manila Electric Railway & Light Corporation has been able to increase wages of eighty men, more or less, by about $700 per month. An outline of the bonus system for the power-plant employees is given in the article by the author. An illustration of a peg board, 18 in. (45.7 cm.) in diameter, used in stimulating competition in fuel saving among the power-plant watches, is also shown. The author states that the bonus system of wages has been in operation for about two and one-half years, with the most gratifying results. The B.t.u. consumption per switchboard kilowatt-hour at the present time is nearly 25 per cent less than it was three years ago. The present saving in fuel cost, based on the latest standard of fuel efficiency, put in effect Sept. 1, 1917, is 8.75 per cent. The company and the employees are equal partners, sharing alike the results obtained from fuel saving, a procedure which escapes the criticism that is sure to arise when a company appropriates the lion's share of the gain for itself.—*Electric Railway Journal*, Feb. 16, 1918.

Installations, Systems and Appliances

Calculation of Discharge Resistances.—PAUL GIRAULT.—In designing a discharge resistor intended to protect apparatus possessing self-inductance against rupture from excessive tensions the following should be determined: (1) The maximum rate of voltage rise; (2) the energy dissipated in the discharge resistor after the rupture; (3) the power lost permanently in the resistor. All these are easily calculable. The author presents simple formulas, with a particular application to an inductor circuit.—*Revue Générale de l'Electricité*, Jan. 19, 1918.

Electric Pumping.—H. W. WAGNER.—An analysis of operating records collected from various sources, information obtained from discussing different operators' problems, the design and characteristics of different types of pumps, cost data, and various tests and service records and general statistics. The booklet is limited to those phases which affect directly electric pumping as compared with engine pumping. Considerable space is given to pumps, while related material which may be found in handbooks, textbooks, etc., is omitted or condensed as much as possible. Conclusions drawn from actual practice as well as live data are elaborated. The booklet is divided into five general sections, the introduction, the summary and conclusions, the equipment and operation, analyses of costs, and results of tests and operating records. The summary is written for the reader who wishes condensed information in plain words. Numerous tables are included giving summarized data, manufacturers' specifications, water consumption, results of tests and operating records.—*Bulletin* 46, *Engineering Experiment Station*, Ames, Iowa.

Electric Welding.—JEAN GUERNER.—An examination into the advantages of electric welding as compared with other methods. Welding by the arc process, mixed (gas and electric) welding and welding by the resistance method are discussed in turn, and the author considers how these different methods apply to various metals and products. He holds that, except for very large pieces, electric welding is always advantageous for continuous work of an extent sufficient to warrant the installation of special generating machinery.—*Revue Générale de l'Electricité*, Feb. 2, 1918.

Electrophysics and Magnetism

Unipolar Induction and Electron Theory.—GEORGE B. PEGRAM.—The author describes experiments that confirm the conclusions of Barnett and Kennard regarding unipolar induction, that the seat of electromotive force is in a moving conductor and is entirely independent of the rotation of the magnetic field. The facts regarding unipolar induction are in accordance with the theory of relativity. According to the well-known mathematical development from the Maxwell field equations in the Lorentz form, there is no force exerted on a sta-

tionary electron, therefore there is no emf. induced in stationary conductors in the vicinity of a steadily spinning solenoid carrying a constant current. On the other hand, when the electron is moving there is an emf. on electrons in moving conductors, which may be easily seen to be quantitatively just what would be computed on the "rate-of-cutting-magnetic-lines scheme," supposing that the lines of the magnetic field would remain stationary with the conductors rotating. Although the conclusion that no emf. is set up in stationary parts of the circuits in a unipolar induction experiment follows immediately from the electron theory, many well-trained physicists and engineers at first are inclined to disagree with the conclusion. They are accustomed to the experience that in general the motion of magnetic fields sets up an electromotive force in the neighboring conductors. They have not examined the rate of variation of the vector potential, which is the only function adequate to express the emf. at a point in the stationary conductors.—*Physical Review*, December, 1917.

Thermal Expansion of Tungsten at Incandescent Temperatures.—A. G. WORTHING.—From experiments made by the author of this paper, the coefficients of expansion at 300 deg. K., 1300 deg. K. and 2300 deg. K. are respectively 4.44×10^{-6}, 5.19×10^{-6} and 7.26×10^{-6}. These values are about one-third greater than those given by Fink.—*Physical Review*, December, 1917.

Electrical Porcelain.—G. I. GILCHREST and T. A. KLINEFELTER.—The object of this article is to bring about a better understanding between production and operating engineers, particularly that the latter may understand the manufacturing standpoint. First, the manufacture of electrical porcelain is outlined step by step; next, the data obtained from an investigation of porcelain mixes and ingredients and their influence on design are discussed, and finally the design itself is taken up.—*Electric Journal*, February, 1918.

Units, Measurements and Instruments

An Optical Pyrometer.—PAUL D. FOOTE.—Two forms of current-measuring instrument are described, one of which is strictly a hot-wire ammeter with the hot wire at a temperature between 600 deg. and 1500 deg. C., and the other a device for adjusting a current, by optical methods alone, to any preassigned value. The first method should prove especially useful for the accurate measurement of alternating current of high frequency. The precision that may be expected in measurement of current through the pyrometer lamp when the instrument is sighted on a source of constant brightness is shown.—*Journal of Washington Academy of Sciences*, Feb. 19, 1918.

The Selection of an Electricity Meter.—A comprehensive method by which different meters can be classed is described. Electricity meters are usually bought in quantities on period contract terms. This makes a right choice particularly desirable, because of the large numbers of meters involved, the long period which must elapse before any desired change can be made, and, for reasons of standardization, the disadvantage of frequent changes. The qualifications of a meter fall under two heads, namely, quality and cost. There are certain other considerations relating to the commercial service given by the different manufacturers. The author tabulates his conclusions thus:

Choice of meter should be guided by:

I. Quality, denoted by:
  1. Accuracy, viz.:
    (a) Initial accuracy, depending on, first, electrical design (affecting errors due to variation of load, voltage, temperature, frequency, power factor and balance of load) and also concerned with starting current, external magnetism, shunt running, insulation resistance and overload capacity; second, workmanship, affecting friction.
    (b) Accuracy after service, depending on, first, durability of materials, jewels etc.; second, stability of adjustments, general robustness, etc.; third, type.
  2. Finish.
  3. Convenience in handling, fixing, sealing and reading.

II. Cost: (1) Prime; (2) running; (3) maintenance.

III. Commercial service: (1) Delivery; (2) facilities for examination and repair on customers' premises; (3) guarantees; (4) courtesy.

—London *Electrical Review*, Jan. 25, 1918.

Telegraphy, Telephony and Signals

Artificial Telephone Lines.—J. B. POMEY.—The artificial line known as the *H* line, so useful in the telephonic studies of laboratories, is patented, and the author therefore considers whether a natural line cannot be represented without infringing on this method. He describes how an artificial line can be constituted with a Wheatstone bridge or any other arrangement desired provided that an adjustment of the branches for the frequencies desired presents no obstacle.—*Revue Générale de l'Electricité*, Jan. 26, 1918.

Miscellaneous

Collapse of Short Thin Tubes.—A. P. CARMAN.—Data are given in this paper which may be applied in designing condenser tubes. The greater part of the paper refers to a series of tests on short, thin tubes of seamless steel, seamless brass, aluminum, glass and rubber. The purpose of these tests was to find an equation by the application of which the pressure required to collapse a tube can be calculated when the dimensions of the tube and the elastic properties of the material are known.—*Bulletin* 99, *Engineering Experiment Station, Urbana, Ill.*

Charging for Electrical Energy According to the Consumer's Power Factor.—P. BOUCHEROT.—Power-factor conditions in France have become very bad since the war began, and not the least important of the means advocated for ameliorating them is that of obtaining the co-operation of the customers of the central station by the adoption of a rational tariff for electrical energy based upon their individual power factors. The author of this article maintains (1) that it would be neither easy nor right to charge for the apparent power; (2) that it is almost exclusively the reactive power of the customer that affects the expenses of the network; (3) that there is a simple method easily applicable to existing meters that will take account of this reactive power. This method consists of the introduction of a small coil of self-induction in the wattmeter circuit where it enters the meter, so as both to reduce and retard the current. By this means, the author holds, rather than by the Arno system, to which he is opposed, the various factors which enter into the problem—the inductor current, the fall of tension, the Joule effect, the losses in the iron, etc.—may be properly handled and a fair method of accounting be made possible. Formulas in support of his conclusions are worked out.—*Revue Générale de l'Electricité*, Jan. 19, 1918.

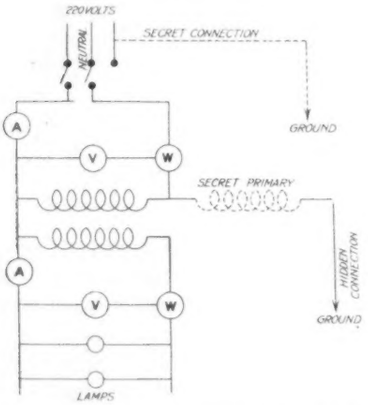
Readers' Views and Comments

An Electrical Swindling Scheme

To the Editor of ELECTRICAL WORLD:

SIR: The writer recently had occasion to expose the following novel scheme for swinding innocent laymen who were asked to put their money into a new method of greatly increasing the number of lamps lighted from the secondary of a "wonderful" transformer, many more than it was possible to light from the ordinary one. This transformer was said to show that the regular transformers are all wrong in principle, that modern electrical engineers do not understand their true principles, etc.—a kind of statement at which capitalists are apt to bite, swallowing the hook and bait before they find that they have been caught.

The transformer for 110 volts, primary, was inclosed in a box supported on insulators and was provided with only two primary wires leading to the neutral and to one of the outside poles of the switch of a three-wire, 220-volt house



THE DOTTED LINES SHOW THE SECRET CONNECTIONS AND SECOND PRIMARY COIL

circuit; the other outside pole was disconnected and not used. The primary ammeter, wattmeter and voltmeter were connected in this circuit. A similar set of instruments was connected in the secondary circuit, from which a set of lamps was lighted. Any one, including the shrewdest of capitalists, could convince himself from these instruments that the power delivered by the secondary was far greater than that entering the primary circuit. The "secret" was in the transformer, hence it was not open for examination.

A careful examination, however, revealed that there was a small wire, carefully hidden from view, leading from the transformer box through the floor. It was found to be attached to a grounded water pipe, to make it appear innocent; the increased amount of power was supposed to come from this great, big earth, where it would not be missed and would cost nothing. In the cellar, however, there was also another secret and supposedly innocent "ground connection" to the other outside supposedly unused pole of the three-wire, 220-volt system as it entered the building. There was evidently a second primary coil in this secret transformer which was getting its current from the street circuit through these two "innocent" ground connections. This, of course, was not going through the primary measuring instruments. The capitalist who was financing this "great inventor" was very ungrateful to the writer for having pricked the bubble, and the writer later regretted greatly not having asked for payment in advance. This swindling scheme will probably crop up again in the South or West. The writer regrets that he cannot publish the names of both the inventor and his capitalist.

Philadelphia, Pa. CARL HERING.

Daylight Saving

To the Editor of ELECTRICAL WORLD:

SIR: In view of the prospect that some sort of a daylight-saving bill will be passed either by the federal government or by the various states, it is proper that the central-station interests should consider the possible results. One possible result is that this change of the clock would reduce the use of artificial light and thereby save fuel and other expenses. If this is going to be the result, it is very clearly the patriotic duty of the central-station people to encourage the change.

Another possibility, and in my opinion a much greater probability, is that the change in the clock will have no appreciable effect on the use of artificial light. I say this in spite of the reports from England and other countries, as I believe the reduction in the use of artificial light there has been due to the numerous other changes caused by the war, rather than to the change in the clock. However, even under this assumption there is no reason why the central-station people should oppose the change and every reason why they should remain neutral in the matter. There are so many well-meaning people who apparently believe that the change in the clock will change everybody's habits that it will require a considerable effort to make an effective opposition to them. Such opposition would be unpatriotic if these well-meaning people are right, while if they are wrong, they will nevertheless do so little harm that the central stations may wisely confine themselves to a position of neutrality.

The reason why we now get up at 5 o'clock (or 6, or 7, or 8, as the case may be, or even at 9, as we often do on those days when we are at perfect liberty to do as we choose), and the reason why we take our rest at noon, and the reason why we go to bed sometimes with the chickens and sometimes with the owls, is because on the whole these hours really satisfy us best, on account of their relation to the sun. When we make a voyage on an ocean steamer we can keep exactly the hours we choose, and we match our hours with the sun so as to enjoy or avoid the sun as suits us best. When we go hunting or fishing we match our hours with the hours of the birds or of the fish. In any small town (not a suburb of a large town) the factory hours are fixed to suit the population of that town, so as to give them the daylight they really want. All these hours of our present habits are flexible and are continually being changed either forward or backward.

Now, if we should have a change in the clock, then the next time, as the next spring or the next fall, that the factory hours and schedules are readjusted they will be readjusted to suit the sun, and that means that even if daylight-saving should temporarily result in our getting up a little earlier in relation to the sun or going to bed a little later in relation to the sun, nevertheless every spring and every fall there would be a tendency to shift back so as to make the hours just as convenient in relation to the sun as they were before the daylight-saving plan went into effect, until within a few years our habits in relation to the sun would be exactly as they used to be.

The result of that would be that the man who now gets up at 7 a.m. would under the daylight-saving plan get up at 8, thinking that he had had an hour's more sleep. He would then dine at 8 instead of at 7, thinking he had got an hour's more golf, and would go to bed at 12 instead of at 11, thinking he had had an hour's more recreation in the evening. In order to gain these advantages, however, he would have to adjust his hours so that his rising time, his dining time and his going-to-bed time would be just the same in relation to the sun as they are now; in other words, he would disregard the daylight-saving clock.

The essential point is that the daylight-saving plan does not increase the number of hours in a day, but only tries to shift them. The baseball people and the golf people may think that it is going to give them an hour more, but the hour that they get is taken from their sleep or work.

Therefore, so long as the daylight-saving law is not going to oblige the offices to open at 8:30 a.m. if the management and the employees prefer either 8 or 9 or some other hour, so long as the law is not going to oblige the factories to start work at 7 a.m. if the operatives and the management prefer 6:30 or 7:30 or some other hour, then the whole daylight-saving scheme will be very much like the story of the man whose wife was beating him. An outsider started to interfere, but the man said, "Don't bother; it amuses her and it does not hurt me, so let her keep on."

If it amuses the daylight-saving people to push their law, the central stations should let them keep on and should not bother about the results either way. R. S. HALE.

Boston, Mass.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ANNUAL MEETING OF THE ASSOCIATED MANUFACTURERS

Spirit of War to Pervade Gathering on March 21 in New York—The Industry in Active War Service

The spirit of war will be dominant in the annual meeting of the Associated Manufacturers of Electrical Supplies at Delmonico's, New York, on Thursday, March 21. War service work for the government, conditions growing out of the war and to be anticipated in the future will be discussed, together with other kindred matters.

At the business meeting to be held at 2:30 o'clock in the afternoon, reports will be presented dealing with international trade conditions of the post-war period, the work of the General War Service Committee of the Electrical Manufacturing Industry and the activities of the association and its sections during the year. Trade acceptances will also be considered. Governors will be elected to take the place of board members whose terms expire.

At the dinner at 7:30 p. m., also at Delmonico's, the war will be in the forefront again. Thus the members will emphasize the fact that, in addition to their enormous output of material for use in the war, a large number of their employees of all ranks are in active service in army and navy.

During the week of the meeting a number of section meetings will be held at the association rooms, including the following:

Monday, March 18.—Interlocking standardization committee, 2 p. m.

Tuesday, March 19.—Snap Switch Section, 10 a. m.; Molded or Formed Insulation Section, 10 a. m.; Socket Section, 2 p. m.; Outlet Box Section, 2 p. m.; Industrial and Street Lighting Fixtures, 2 p. m.; Attachment Plug Section, 4 p. m.; Insulating Materials Section, 4 p. m.

Wednesday, March 20.—Panelboard and Switchboard Section, 10 a. m.; Fuse Section, 10 a. m.; Fan Motor Section, 10.30 a. m.; Knife Switch Section, 2 p. m.; Non-Metallic Conduit Section, 2 p. m.; inclosed externally operated switches, immediately following Knife-Switch Section.

Friday, March 22.—Line Material Section.

SIGNALING APPARATUS SECTION FORMED

In response to an invitation to manufacturers of bells, buzzers, annunciators, fire-alarm and telephone apparatus, signal gongs, etc., a meeting was held in the quarters of the Associated Manufacturers of Electrical Supplies, New York, on Feb. 20, for the purpose of considering the formation of a section.

The following manufacturers were represented: Ansonia Electrical Company, L. F. Anschutz; Edwards & Company, Inc., R. Edwards, Jr.; Holtzer-Cabot Electric Company, M. J. McElevy; Manhattan Electrical Supply Company, E. Whitmore; Patrick & Wilkins Company, E. Ward Wilkins; Stanley & Patterson, George L. Patterson and Albert S. De Veau.

Charles E. Dustin, general secretary of the association, explained the objects and aims of the association and the work being done by the various sections along lines of standardization, co-operation, etc. After an extended discussion it was voted unanimously to form the Signaling Apparatus Section, to embrace in its membership the manufacturers of signal gongs, telephone apparatus, fire-alarm apparatus, annunciators, bells and buzzers and contact devices.

R. Edwards, Jr., Edwards & Company, Inc., was elected permanent secretary of the section, and E. Whitmore, Manhattan Electrical Supply Company, permanent treasurer. George L. Patterson, Stanley & Patterson, has been elected to serve as permanent chairman of the new section.

Lessons to Employees on the Waste of Food and Materials

To impress upon employees evils of waste the management of the Westinghouse Electric & Manufacturing Company has fitted up a storage-battery truck as a traveling exhibit. Upon it is a collection of food wasted, including bread, butter, meat, cakes, crackers, pickles, cheese, fruits, etc., as well as a quantity of manufacturing materials, such as copper, zinc, lead, mica, rubber, felt, gum and similar materials, much of which could be used to considerable advantage.

It is estimated that foodstuffs wasted per day amount to between $35 and $50, the cost of which comes out of the pockets of employees. The waste of material amounts to hundreds of dollars per day, which would be a loss to the company if it were not that men are continually sorting the seemingly scrap material and turning it back for use or so that the highest price may be obtained for it from dealers in such material.

This truck was driven up and down the shop aisles so that employees could look upon it.

STREET-LIGHTING CURTAILMENT UNPOPULAR IN NEW ENGLAND

Inquiry by Representative of "Electrical World" Leads to Belief that Such Attempted Economies Give Unsatisfactory Results

As a result of the recommendations of James J. Storrow, Fuel Administrator of New England, a substantial cut in street lighting has been on trial in some of the larger cities since the middle of February. The cut was made with the object of saving coal, but the results do not appear to have justified the curtailment. In some cases a moonlight schedule was adopted; in others heavy cuts were made in the "white-way" type of lighting used locally and in regular street-lamp service.

Talks with various central-station officials by a representative of this journal lead directly to the belief that street illumination by ordinary arc or incandescent units offers one of the poorest opportunities in existence to attempt to secure coal economies by curtailment.

EXPERIENCE IN CITY OF BOSTON

In the city of Boston 3200 gas lamps have been cut out, of a total of 9813 single-mantle and 70 double-mantle units. About 1000 magnetite-arc lamps have been cut out, the total of the latter (500 watts rating each) in service Jan. 1 being 5180. Twenty-two Thoran arc lamps have been replaced by magnetites in the public squares, Common and Public Garden. Over 5600 series incandescent lamps were in street service Jan. 1, and none of these has been cut out.

Nothing has been attempted in the city of Boston in the way of running the street lamps on a moonlight schedule. The arc lamps cut out of service in Boston were largely in parks, playgrounds and residential districts in the outlying wards. The general policy followed was to cut out lamps in the middle of street blocks, but to avoid cutting out those on street corners unless the service was duplicated. A total of forty arc lamps was cut out in the Common and Public Garden alone, in the downtown area. Business streets downtown were left almost entirely free from cuts, not a dozen lamps all told being shut down in the business section. Sixty-two white-way or boulevard type of lamps were cut out. The water-front and bridge lamps were untouched.

A good deal of complaint has been received since the shutting off of lamps, and the police authorities have contended in some cases that crimes would not have occurred had the lighting been up to the usual volume. In one particular case where an arc lamp was cut out in front of a store the establishment was twice broken into and it was necessary to replace the lamp.

Just what basis of settlement will be made with the Boston Edison company for these curtailed lamps has not yet been made public. In his letter to the chairmen of local fuel committees, Mr. Storrow pointed out that it is probable that, owing to existing definite contracts for street lighting, utility companies will expect a definite adjustment in remuneration to be made before adopting any restriction in street lighting.

This, Mr. Storrow said, "is of minor importance in comparison to the necessity for fuel conservation at this particular time, and we therefore ask you to use your best efforts to get an immediate curtailment of street lighting in your district and leave the adjustment of remuneration between the public utilities company and local authorities to a later period, when it can be satisfactorily worked out."

SPRINGFIELD OPPOSED TO CURTAILMENT

At Springfield, Mass., Mayor Stacy declined to favor street-lighting curtailment, contending that such a policy invites danger and tends to lead to increased crime.

William E. Hodge, deputy superintendent of street lighting, Springfield, informed a representative of the ELECTRICAL WORLD that he was opposed to street-lighting curtailment and was convinced that the saving in fuel so obtained would be merely nominal. Mr. Hodge pointed out that the street-lighting load is for many stations about the only load which is of any value from the standpoint of station efficiency during the small hours of the night, and its cutting off might in some cases affect station economy adversely. The total connected load of the Springfield street-lighting system is only about 1000 kw., and the service is supplied partly from steam-driven plants and partly from hydroelectric plants.

Mr. Hodge also said: "If only 3 per cent of the coal burned in the country, as the ELECTRICAL WORLD states, is consumed by central stations, and only a fractional part of the central-station output is street-lighting load, the saving of coal to be effected by curtailing street lighting is altogether too small to be justified, considering the importance of proper street lighting in community life."

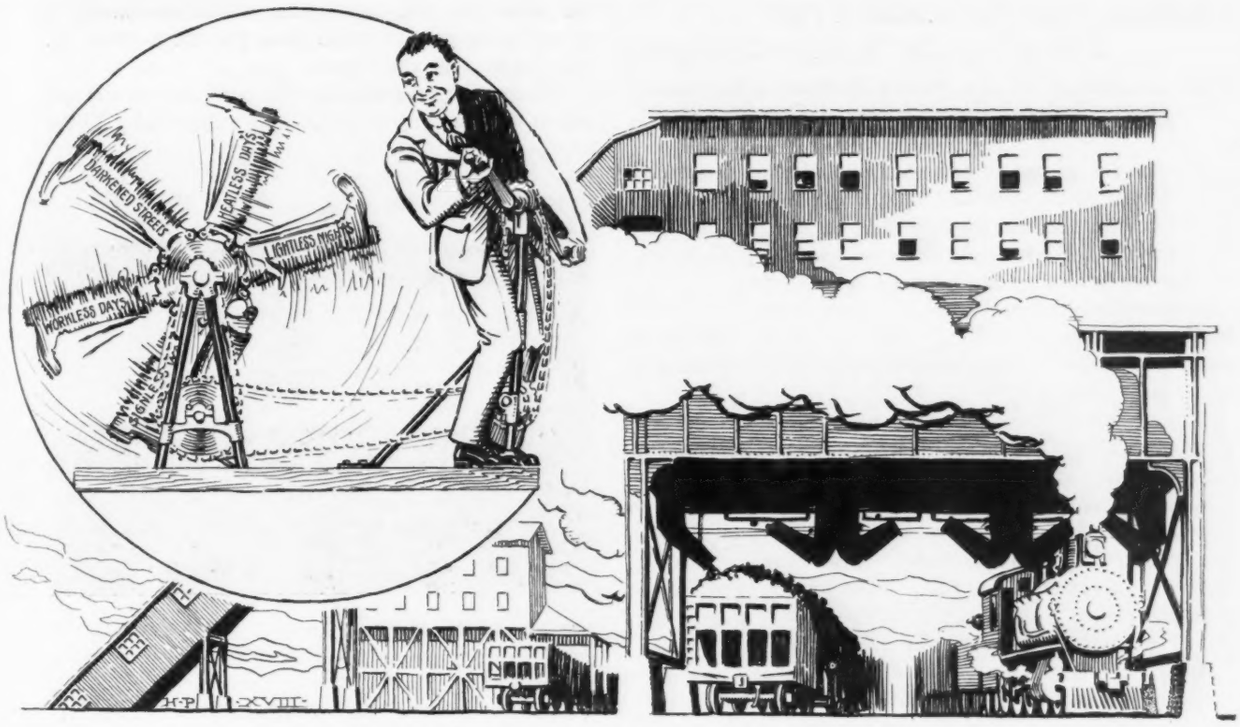
IN CAMBRIDGE, WORCESTER AND SALEM

In Cambridge, Mass., a moonlight schedule was attempted for a time, but it aroused so much opposition on the part of women residents that the lamps were restored. At present all street lamps in Cambridge are operated until 11:15 p. m. only, including the all-night white-way lamps. The midnight white-way lamps are not at present operated.

At Worcester, Mass., all lamps have been put back on the former schedule except the luminous arcs of the white-way type which used to be run until 1 a. m. The luminous-arc system in Worcester comprises 600 lamps, half of which were run 4000 hours yearly and half until 1 a. m. daily. For about six weeks the regular street-lighting system, composed of 400-watt direct-current magnetite-arc lamps and series incandescents, was cut out at midnight. These are now run from dusk to daylight.

No special increase in crime or accidents was noted in Worcester, and the restoration of most of the service as above outlined followed improvement in the delivery of coal to the Worcester Electric Light Company.

Salem, Mass., cut off all its street lighting for a few days early in the year to save coal. The results were bad walking and a serious assault case which aroused public sentiment to the point of demanding the restoration of the lamps. The service was soon restored. In this case the Salem Electric Lighting Company did not credit the city in cash for the lamps cut out, but adopted the plan of burning lamps in future extensions a certain period to offset the hours lost owing to the lamps that were cut out.



Let Us Build Up the Best Machine to Win the War

LOS ANGELES AQUEDUCT POWER TO SAVE OIL CONSUMPTION

California Fuel Administrator Is Advised that Surplus Power Could Suppy Demand Now Served by Steam Plants

Moves toward economizing fuel consumption were considered at a recent conference in Los Angeles between the Public Service Commissioners and a representative of the California State Fuel Administrator. The chief topic was the diversion of city funds for duplication of the present distributing system to the development of aqueduct water power, this consideration being the result of the Federal Fuel Administrator's recommendation to develop hydroelectric power.

E. F. Scattergood, electrical engineer Aqueduct Power Bureau, reported that of the $5,000,000 voted for a distributing system nearly half was available. Aqueduct power could be developed to supply all consumers now served by the Los Angeles Gas & Electric Company steam plants. This could be effected within a year, he believed, by completion of Power Plant No. 2 in San Francisquito Canyon and utilizing to the full the capacity at No. 1. This would mean a total of 33,000 hp. added to the present capacity.

The total cost of consolidating the three Los Angeles systems and increasing city generating capacity to a point where it could meet all needs would be about $1,400,000 at present machinery quotations, but 35 per cent of this could be saved and prompt delivery of machinery assured if government intervention could be secured. Of this total about $40,000 represented cost of connection with the Los Angeles Gas & Electric Corporation, which could be effected in about a month.

Mr. Scattergood's written report read, in part:

> In addition to supplying the 9000 consumers and the street-lighting load connected to municipal lines as well as power requirements under the operating agreement with the Southern California Edison Company, the city plants have a large surplus capacity. From this surplus the city is now supplying all power used by the Pasadena municipal plant, thus eliminating consumption of approximately 5000 bbl. of fuel oil per month at the Pasadena steam plant. In addition to supplying Pasadena, the city plants have surplus sufficient for practically all of the electric power generated by the Los Angeles Gas & Electric Corporation steam plants for use of electric consumers of that company within the city.

It is understood that the substitution of aqueduct power for that generated by the private company in steam plants would save 45,000 bbls. of oil per month. The private company has offered to purchase the available power from the city or to co-operate in oil conservation in such other manner as the Fuel Administrator may direct.

MONTHLY MEETING OF THE NEW YORK ELECTRIC CLUB

Jobber Has Three Functions in Distributing Goods, Says F. M. Feiker, in Addressing the Members

The second monthly meeting of the New York Electric Club was held March 5 at the Hotel Breslin, New York. F. M. Feiker, editorial director of ELECTRICAL WORLD and *Electrical Merchandising*, addressed the meeting on "The Place of the Jobber in the Electrical Industry." He stated that the jobber has three functions in distributing goods. First, he carries a stock, in many large houses running as high as 50,000 different items; second, he takes the credit risk, and, third, he creates new business.

J. C. McClernon of the Northwestern Electrical Supply Company is president of the club, and W. J. Krieger, with offices at 47 West Thirty-fourth Street, New York City, is the paid secretary.

CAPITAL ISSUES COMMITTEE ENLISTS STATE COMMISSIONS

War Committee of the Public Service Commissions Meets Federal Reserve Board Committee to Co-operate in Conservation

On the invitation of the capital issues committee of the Federal Reserve Board, that committee and its advisory committee held a conference on Feb. 28 in Washington with the war committee representing state public service commissions. There were outlined to the representatives of the public service commissions the aims and purposes of the capital issues committee along the lines of conservation of capital, labor and materials.

The efforts of the committee to bring about curtailment of capital expenditures throughout the country, except where absolutely necessary for prosecution of the war or health and welfare of the community, were stated to the commissioners and received their hearty approval. The commissioners have already accomplished a great deal on these lines and expressed the greatest desire to co-operate in every way possible to subserve national interests during the war.

At an early day a statement of the aims of the capital issues committee will be presented to the commissioners and transmitted by them to the various public service commissions, accompanied by a bulletin recommending nation-wide co-operation and prescribing forms of procedure.

PUSHING THE SALE OF THRIFT STAMPS

Twenty-eight New York Lighting Companies Selling the Government War Savings Stamps to Employees and Customers

In their work of promoting the sale of War Savings stamps the New York lighting companies are under the active leadership of Frank W. Smith, vice-president and general manager United Electric Light & Power Company, who is doing effective work in co-operation with the National War Savings Committee appointed by the Secretary of the Treasury. Mr. Smith is chairman of the executive committee of the gas and electric light, heat and power group of the pioneer division. The other members of the committee are F. R. Barnitz, H. M. Edwards, S. H. Giellerup, secretary; L. A. Coleman, director of War Savings Societies; R. B. Grove, director of speakers.

There is also a publicity committee, composed of a representative from each of the companies, as follows: R. W. Allen, F. R. Barnitz, I. M. Beatty, J. I. Blanchfield, J. T. Brown, Jr.; W. L. Bruce, D. Darlington, M. E. Dillon, C. J. Ferdon, M. M. Graham, George Kerr, H. G. Leask, W. F. O'Brien, P. J. Schneider, Henry Schreiner, J. L. Thomas, C. H. Webster, H. L. Wilder, E. S. Young, S. H. Giellerup, chairman.

A number of those who are active in furthering the sale of the stamps through the companies met at a lunch at the Engineers' Club, New York, recently, together with representatives of the New York branch of the national committee. Plans were formulated for reaching all employees and customers. The gas and electric group has been assigned $1,500,000 of New York's quota of $100,000,000. In order to sell these stamps it will be necessary for the twenty-eight companies in the group to dispose of more than $30,000 worth each week for the rest of the year.

Outdoor signs, posters, collectors and advertising material were among the mediums suggested. The United

Will Silver Serve?
Make that 25 Cents work for you and Uncle Sam—Interest for you, War Supplies for Him
BUY
War Savings Stamps
On Sale at all
Gas & Electric Offices
Serve, Save and Sacrifice

Electric Light & Power Company has painted all of its signs with war savings stamps copy. Hundreds of lithographed posters, it was announced, had been distributed and were now prominently displayed at every gas and electric office in Greater New York. The group has prepared a poster asking customers to take their

change in thrift stamps, and this now hangs in front of every cashier's window.

Since the luncheon war savings societies, under the direction of L. A. Coleman, are being established in all the companies so that every one of their 21,000 em-

ployees who is able to do so may pledge himself to the purchase of one or more thrift stamps a week. Mass meetings of employees are being held at which short talks are given on the subject of thrift by speakers from the national committee.

Record is kept of the stamps sold by each company and a weekly report is circulated among them so that each may know how the others stand. The Edison Electric Illuminating Company of Brooklyn is in the lead at present, being seventeenth of the companies of all descriptions selling thrift stamps in New York City.

FIGURE FUEL SAVING BY CLOSING PRIVATE PLANTS

J. W. Lieb Estimates Economy of 500,000 Tons in New York District—Fuel Administration in Nation-wide Inquiry

The question of whether, in the interest of the coal conservation, private electric plants should not be closed down and energy obtained from central stations was the subject of a hearing March 4 before the New York Public Service Commission, First District. This step has been advocated by Albert H. Wiggin, State Fuel Administrator, in a letter sent to private-plant owners and operators recently. The United States Fuel Administrator was represented at the hearing by C. E. Stuart, engineer of the conservation division.

Another phase considered was as to whether it would be possible for private plants in business buildings to be shut down during the summer months, when energy could be purchased from the New York Edison or one of the other large electric corporations, but still to be operated during the winter months when the exhaust steam might be used for heating the buildings.

J. W. Lieb, vice-president and general manager New York Edison Company, thought that if all of the 650 private plants in Manhattan and the Bronx were shut down and energy purchased from the electric corporations, it should result in a saving perhaps as high as 838,000, or, conservatively, 500,000, tons of coal per year.

W. F. Wells, vice-president and general manager Edison Electric Illuminating Company of Brooklyn, stated that there were about 570 private plants in Brooklyn divided in various classes. He believed that about 100,000 tons of coal could be saved by using central-station energy.

An announcement of the Fuel Administration, issued in Washington, says in part:

Albert H. Wiggin, Fuel Administrator of New York State, has addressed a letter to the owners of fifty isolated electric generating stations in New York City, calling attention to the necessity of obtaining the greater economy of fuel which will result from the load of these and similar stations being carried by large central stations. Very gratifying replies have been received from many of the owners of such stations.

The hearings of the Public Service Commission will develop the means; also the complications attendant upon effecting a conservation of fuel in this manner. It is desired in no way to bring hardship to the owners of such plants or to the tenants or interests dependent upon such plants.

A nation-wide investigation is now being made on this subject. It has already been demonstrated in many localities that centralization of power may be effected not only without hardship but also with a considerable saving from these angles.

Representatives of the United States Fuel Administration have left Washington for New York to attend a series of hearings before the Public Service Commission of that city at which the general proposition will be discussed of saving coal through the elimination of isolated and non-economical private electric power and heating plants.

According to reports made to the Fuel Administration, millions of tons of coal can be saved and turned to domestic supply and war uses if these plants are closed down in the industrial centers of the country for the period of the war. In addition, the rail and barge trains and cartage problem would be lessened and terminal congestion relieved.

LONDON ELECTRIC COMPANY WILL SUSPEND OPERATION

Unable to Meet Competition of Hydro-Electric Power Commission of Ontario, Private Corporation Will Dismantle Plant

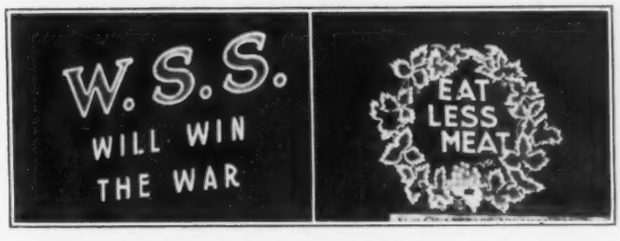
Unable to meet rates of the Hydro-Electric Power Commission of Ontario, Canada, the London Electric Company, Ltd., a corporation controlled by Mackenzie & Mann, will suspend operation.

The London Electric Company has served notice on customers taking approximately 2500 hp. that it will terminate its business in London about March 15. Its plant will be dismantled and scrapped.

The London Electric Company formerly sold power for 9 cents per kilowatt-hour net, plus meter rent. When the Hydro-Electric Commission entered the field it charged 4.5 cents per kilowatt-hour. It gradually reduced charges to 1.5 cents per kilowatt-hour, and the London Electric Company was unable to compete.

When the private company was unable to secure coal for its plant during the recent shortage, directors decided to suspend operation. It is reported that the Ontario government has ordered Mackenzie & Mann to turn over two of its generating machines at Niagara Falls, Ont., to the Hydro-Electric Commission.

War-Saving and Food-Saving Signs in New York City



Electric signs have been donated and are being maintained by the O. J. Gude Company, New York, without charge to the government, for war savings stamps and the Food Administration.

The "W.S.S." sign is on the roof of the fourteen-story Mecca Building, on Forty-eighth Street between Broadway and Seventh Avenue, towering above Longacre Square and showing many blocks down Broadway. The structure is 45 ft. (13.7 m.) high by 107 ft. (32.6 m.) long and the letters are 16 ft. (4.8 m.) high.

The "food" sign is at the northeastern corner of Longacre Square and shows down Broadway toward the Hotel Astor. In the center of the artistic wreath the words "Eat Less Meat" and "Eat Less Wheat" flash alternately. The structure is 33 ft. (10 m.) high and 48 ft. (14.6 m.) long, and the letters are 4 ft. (1.2 m.) high.

NEW JERSEY RATE INCREASE AUTHORIZED BY COMMISSION

Public Service Electric Company of Newark Granted Higher Schedule to Yield About $1,000,000 Additional Revenue

As a war emergency measure the New Jersey Board of Public Utility Commissioners has authorized an increase in rates of the Public Service Electric Company, Newark. The higher rates are designed to yield an increased revenue of approximately $1,000,000 a year.

In acting, the board emphasizes that the advance is solely a war emergency measure and does not affect the reasonableness of the proposed rates in normal times. It also reserves the right to abrogate or modify the new rates should conditions indicated by operating results warrant such action.

The decision allows a war addition to each bill of power consumers of 25 per cent. There is also a surcharge for coal cost.

OTHER INCREASES

Supplementing the announcement of the decision of the Pennsylvania Public Service Commission, published in the issue of the ELECTRICAL WORLD for Feb. 23, 1918, granting higher rates to the Philadelphia Electric Company, it may be stated that the added charge of 10 per cent applies to the entire schedule of light and power rates, with the exception of residence and municipal rates. The increase applies to the railway and railroad rates.

An increase in electric rates of the Wilmington & Philadelphia Traction Company in Wilmington, Del. has been authorized. The domestic rate will be advanced about 1 cent per kilowatt-hour, making it 9½ cents.

DATA ON RETAIL COSTS ARE TO BE CO-ORDINATED

Directors of Society for Electrical Development Vote to Promote Proper Electrical Mechandising and Appoint a New Committee

A special meeting of directors of the Society for Electrical Development was held at the offices, New York, on Tuesday, March 5.

The directors present were: President Henry L. Doherty, in the chair; Joseph E. Montague, Gerard Swope, W. E. Robertson, Fred Bissell, Earnest McCleary, James R. Strong, J. Robert Crouse, Charles W. Price, James H. McGraw, represented by F. M. Feiker; J. M. Wakeman, general manager; James Smieton, Jr., secretary-treasurer.

General Manager Wakeman read his report, which was approved and ordered printed for distribution to members.

The committee appointed at the November, 1917, meeting to consider the plan to promote proper electrical merchandising, with James R. Strong as chairman, reported:

Whereas the electrical business is capable of great expansion, and whereas this can be partly accomplished by improving the merchandising abilities and facilities of those engaged in it, and whereas such expansion will be aided by collecting information on the best ways of merchandising and distributing this to members and others engaged in the industry, and whereas in such expansion a full knowledge of the best methods of proper cost accounting and their application and its broad dissemination is of the utmost importance, it is hereby

Resolved, that the committee recommend to the Board of Directors of the Society for Electrical Development that it take steps to extend the work of the society along these lines.

President Doherty spoke of the possibilities of improving electrical merchandising conditions and expressed sympathy with the idea that such merchandising should be done on a profit-bearing basis.

The report of the committee was accepted and approved.

After considerable discussion, Fred Bissell, Toledo, offered the following resolution:

The general manager to collect information on the best methods of accounting on costs, expenses and earnings in the retail electrical merchandising field, and to arrange this information in a form suited to the needs of the merchants and report to the committee to be appointed by the chair with power to act, and when approved to print and distribute the report to our members.

This was carried unanimously.

The following committee was appointed to receive the report of the general manager as soon as the necessary material has been got together and a tentative plan outlined: Gerard Swope, chairman; H. B. Crouse, J. R. Strong, J. E. Montague, F. M. Feiker.

Encouraging Loyalty and Good Work by Employees

You are at work on a percentage contract, in relation to which the Lord Electric Company is acting as a trustee to safeguard the owner's interests.

In this case the owner is the United States of America, which is spending billions of dollars and is committed to spend millions of lives if necessary, in the cause of Liberty, Honor and Happiness.

Every citizen of this country is expected to "Do his bit." You can do yours by giving us the very best service of which you are capable. Keep yourself fit at all times. Hustle every minute while at work. Report any slacker to your foreman.

Follow these simple rules; then the unit costs of the work will be as low, if not lower, as work on flat contract basis; furthermore, you will uphold the good name of your employer while performing your duty to your country.

LORD ELECTRIC COMPANY

(signed) F. W. Lord,

President.

The notice reproduced herewith is posted by the Lord Electric Company, New York, at places where work is being done by the company for the government. It was received by the ELECTRICAL WORLD from a Washington correspondent.

F. W. Lord, when asked by the ELECTRICAL WORLD whether he cared to make any comment in connection with the publication of the notice, said that the men employed by the company on government contracts were doing fine work and that he believed that the appeal to their loyalty had met with a warm response.

SUPREME COURT DECIDES NEW RETAIL PRICE CASE

Holding that Alleged Price-Fixing Contract Was Contrary to the General Law, Highest Tribunal Follows Previous Rulings

The United States Supreme Court rendered on March 4 a decision holding that contractual notices on patented articles cannot be drawn for the purpose of fixing the retail price. The case was that of the Boston Store, Chicago, against the American Graphophone Company and the Columbia Graphophone Company.

Chief Justice White, in announcing the decision, said in part:

In a general sense the questions involve determining whether the right to make the price maintenance stipulation in the contract stated and the right to enforce it were secured by the patent law and, if not, whether it was valid under the general law and was within the jurisdiction of the court, on the one hand because of its authority to entertain suits under the patent law, or its power on the other to exercise jurisdiction because of diversity of citizenship. We at once say, despite insistence in the argument to the contrary, that we are of the opinion that there is no room for controversy concerning the subjects to which the questions relate, as every doctrine which is required to be decided in answering the questions is now no longer open to dispute as the result of prior decisions of this court, some of which were announced subsequent to the making of the certificate in this case.

Under this situation our duty is limited to stating the results of the previous cases, to briefly noticing the contentions made in argument concerning the non-applicability of those results to the case in hand, and then to applying to the questions the indisputable principles controlling the subjects which the questions concern.

Applying the cases thus reviewed, there can be no doubt that the alleged price-fixing contract disclosed in the certificate was contrary to the general law and void. There can be equally no doubt that the power to make it in derogation of the general law was not within the monopoly conferred by the patent law, and that the attempt to enforce its apparent obligations under the guise of a patent infringement was not embraced within the remedies given for the protection of the rights which the patent law conferred.

It becomes, we think, unnecessary to do more than say that we are of opinion that the attempt in argument to distinguish the cases by the assumption that they rested upon a mere question of the form of notice on the patented article or the right to contract solely by reference to such notice is devoid of merit, since the argument disregards the fundamental ground upon which, as we have seen, the decided cases must rest.

BUSINESS RECOMMENDATIONS FOR USE OF WATER POWER

Report of Special Committee of Chamber of Commerce Is Basis of Questionnaire Sent to 500,000 Business Men

What legislation, if any, might Congress wisely pass for encouraging the development and conservation of the water-power resources of the United States? Would their extensive development, involving such enormous quantities of unused energy, estimated as greater than the total steam power now in service, be industrially practicable? Is it possible, in the case of any enterprise so costly to initiate and so heavily burdened with fixed charges, to outline the essentials of a fair contract which shall protect the interests of the public and at the same time shall make water-power projects sufficiently attractive to capital to secure their development? What legislation can be devised for obtaining this result?

That briefly summarizes the question sent out to more than 500,000 business men by the United States Chamber of Commerce for a referendum vote.

COLLECTING WAR DATA FROM ELECTRICAL MANUFACTURERS

Form of General Questionnaire Approved for Confidential Work of General War Service Committee of the Electrical Manufacturing Industry

Rapid progress has been made in the organization of the various groups of electrical manufacturers underlying the General War Service Committee of the Electrical Manufacturing Industry.

The form of questionnaire approved for the group committees states that "the information desired is for the single purpose of assisting the government and will be held absolutely confidential and used in no other way."

The questions follow:

1. Please list here the lines which you manufacture or assemble.
2. Please furnish printed matter descriptive of same, such as catalogs or bulletins.
3. Is your plant 100 per cent in service?
4. Are you doing government work directly or indirectly at present? What percentage of your government work is electrical? What percentage of your government work is in lines other than electrical?
5. Are you desirous of doing government work in your own line?
6. Are you desirous of doing government work in such other lines as your machinery or plant would be capable of?
7. Is your machinery suitable for any other class of work than the type you are accustomed to turning out?
8. What kind of work could you do outside of your regular line?
9. Can you do more work in your own line at present or in the near future?
10. Please give total square feet of floor area occupied at present.
11. Have you room for expansion on short notice?
12. Is your government work displacing commercial work? And to what extent in per cent?
13. How many hours per week constitute full time?
14. Are you running overtime and to what extent?
15. Have you all the labor required for your present business?
16. Could you obtain more labor if it became necessary?
17. Are you having any difficulty in obtaining raw material for government work?
18. Have you room for additional machinery? (square feet)
19. Have you a sufficient stock of raw materials for your present requirements, also for increase?
20. Have you sufficient coal for your requirements?
21. Do you make your own dies, jigs and tools?
22. Do you build any of your own machinery?
23. Can you build machinery?
24. Do you manufacture any materials (so-called non-essentials) which do not directly or indirectly contribute to the assistance of the war emergency?
25. If so, to what extent?
26. What percentage of the so-called non-essentials can be produced without interfering with your maximum production of articles essential in the war emergency?
27. Furnish any other information that you think would be of service to the government.

The questionnaire is varied slightly where necessary to meet the requirements of individual groups.

STREET-LIGHTING RATES ARE REDUCED IN BOSTON

Result of Arbitration Between Edison Electric Illuminating Company and the City Is a Lower Price for the Service

Sweeping reductions in Boston street-lighting rates are announced in a decision of the Massachusetts Gas & Electric Light Commission made public on March 2 in the celebrated arbitration case between the city of Boston and the Edison Electric Illuminating Company. The arbitration has extended over more than three years, involving over 10,000 pages of testimony and more than 360 tables and exhibits. It is estimated that the reductions established will save the city about $600,000 during the life of the contract arbitrated from Nov. 6, 1914, to Nov. 6, 1924.

The arbitration took place as a result of the agreement between the city and the company, which requested the board to investigate and decide whether the street-lighting rates are as a whole fair, taking into account length of term, discount and all other pertinent matters. Under the agreement the commission had no authority to interfere with the contract rates unless it determined that a fair price for the entire service supplied to the city is less than the total amounts to be paid according to the schedule. Therefore the primary question was whether a fair price for the entire service was less than these amounts. The agreement authorized the board in that event to reduce one or more of the rates charged, substituting such rates from the beginning of the agreement for the corresponding rates in Schedule E. The schedule prices per lamp per year and the amounts awarded are as follows:

	Schedule	Board Price
Magnetite arc, 800-cp.	$87.530	$79.60
40-cp. incandescent	18.333	15.92
60-cp. incandescent	21.136	17.69
80-cp. incandescent	29.310	22.94
100-cp. incandescent	33.426	29.98

On the agreement date there were 4543 magnetite arcs, twenty-four flaming arcs and 4083 incandescent lamps of 40-cp. to 400-cp. rating, 2910 being of 40-cp. size. Lamps and equipment were supplied by the company at its expense, save certain former gas-lamp posts owned by the city and later used for electric lighting. The agreement provides for extensions of service, relocations of lamps and substitutions of other type lamps, but upon terms designed not to increase thereby the relative cost to the company of supplying service and to compensate the city for any reduction in such cost. Also, the number of lamps of any type required by the city shall not at any time during the agreement, save as streets may be discontinued, be less than 95 per cent of the maximum number of such lamps in service at any time prior to the agreement.

The company computed a cost greatly in excess of the aggregate price for the service expressed in the contract, but the figures were made before close analysis of costs was undertaken in its behalf. The greatest differences in estimated costs of the property involved arose with respect to the distributing system and especially the underground installation.

The aggregate cost to the city of the lamps in service on the date of the agreement was $479,718.70 per year. The concrete question was whether or not this is a fair price for the entire service. The city conceded the soundness of basing the price upon cost, but re-examined all expense and property items exhibited by the company and challenged many. Comparative summaries follow:

	Company	City
Operating expenses	$314,013	$235,986
Taxes	60,503	42,096
Depreciation	42,000	34,622
Return	197,994	96,571
Total	$614,510	$409,275

The decision of the commission says in part:

A fair price for the entire service supplied the municipality must in any event take into account such exclusive costs both of investment and operation. But, when it comes to the investment and expenses common to the company's entire system and business, any assignment to the city of a definite share in each item depends primarily on the assumed necessity of making such assignment.

The careful examination of every detail of the company's affairs during these long hearings made it clear that had the company never lighted the streets of Boston there is little, if any, of its plant other than that devoted exclusively to the service with which it could or would have dispensed. Even while the case was pending the growth of the commercial business changed substantially the ratio of the city's demand to the company's peak—a ratio used repeatedly in determining and stating with "illusive inexactness" items of investment and expense attributable to the city. Neither party sought to measure the fair price of the entire service by its cost if independently performed, and both parties recognized the community of interest alluded to in dealing with the generating and transmission expenses.

In view of the terms of the arbitration and for reasons already stated, it seems to the board unnecessary and inexpedient to consider and decide one by one the many issues tried by the parties. Were it to do so, it would at best have reached merely a theoretical estimate of an assumed investment for Boston street lights on the day when the contract became effective, and a finding as to the actual and reasonable costs of and their allocation to the service for the preceding year; whereas the terms of the arbitration call for a determination of "a fair price for the entire service" to be performed under the contract and during its life. Neither has the board deemed it appropriate to discuss in this finding the numerous questions of general policy raised at the hearings. Certain of them directly affected costs and expenses. Others did not find expression in figures, but rather in the assertion of equities favorable to the city.

The evidence disclosed hidden among the legal expenses of the company large payments made for the maintenance of lobbies at the State House and City Hall. Aside from the exclusion of such items, in finding a fair and reasonable cost of the service, the board, in view of its public character and of the paramount duty of seeing that the companies under its supervision in the conduct of their business and the uses and devotion of their resources practice and maintain high civic standards, feels bound to condemn such expenditures as wholly unwarranted and inconsistent with such standards.

Upon the whole, the commission finds that a fair price for the entire service supplied to the city is less than the total amounts to be paid according to Schedule E of the contract and is the sum of $437,000, and it therefore reduces the so-called running costs per lamp-hour in the following rates charged according to Schedule E, with respect to the following described lamps and with the resulting prices for 3828 hours a year after deducting a discount of 10 per cent:

40-cp. series incandescent lamp from 0.25 to 0.18 cent.... $15.92
60-cp. series incandescent lamp from 0.30 to 0.20 cent.... 17.69
80-cp. series incandescent lamp from 0.40 to 0.30 cent.... 22.94
100-cp. series incandescent lamp from 0.50 to 0.40 cent.... 29.98
800-cp. series magnetite 500-watt d.c. arc lamp 1.60 to 1.37 cent. 79.60

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

New-Business Meeting of O. E. L. A. Postponed.—This meeting has been postponed from March 6 to March 20 and will be held at Columbus, Ohio.

The Electrical League of Cleveland.—Victor Morgan, editor of the Cleveland *Press*, addressed the Electrical League of Cleveland, March 7, on the subject "Germany To-day."

The Automobile Headlight Problem.—C. A. B. Halvorson talked on this subject at a meeting of the Schenectady Section of the A. I. E. E. on March 1. He discussed the general principles involved in the problem of obtaining adequate and safe headlight illumination for automobiles.

Automatic Substations.—The next meeting of the Pittsburgh Section of the American Institute of Electrical Engineers will be held March 12. R. J. Wensley will deliver a paper on "Automatic Substations." The paper will be illustrated with lantern slides and should be of especial interest to operators of steel mills and electric railways.

North Dakota Society of Engineers.—M. L. Hibbard, manager of the Fargo (N. D.) division of the Northern States Power Company, addressed the North Dakota Society of Engineers Feb. 21, on the subject "Illuminating and Heating." In the course of his talk Manager Hibbard predicted great development in the use of North Dakota's resources of lignite for fuel.

Los Angeles Jovian Electric League.—At the regular luncheon of the league on Feb. 27 U. Oyama, Japanese Consul at Los Angeles, spoke on "Japan." H. W. Doubrava of the Wagner Electric Company was chairman of the day. At the Feb. 23 meeting of the league F. R. Feitshans spoke on "Alaska," touching on its wonderful possibilities for commercial development. Mr. Feitshans has just returned from Alaska, where he was the guest of the Government Railroad Commission.

Anniversary Meeting of Spokane Section of A. I. E. E.—The fifth anniversary of the Spokane Section of the A. I. E. E. was celebrated in Spokane (Wash.) recently by a gathering of forty-five engineers. J. B. Fishken, J. W. Hungate, George Harding and M. W. Birkett were elected delegates to the Spokane Engineer-Technical Association, composed of all engineering chapters having headquarters in Spokane Details on the distribution of electrical energy by overhead and underground systems were given in addresses by G. H. Hopkins, E. L. Blaine, F. L. Rohrbach, O. O. Coffman and J. G. Finley of Spokane.

Engineers and Architects' Club of Louisville.—A regular meeting of this club was held on Feb. 19, a paper on "Concrete Ships" being presented by J. E. Freeman. The officers elected for the ensuing year are: President, Addison W. Lee; vice-president, L. C. Baird; secretary, Hermann Wischmeyer. The National Bank of Commerce acts as treasurer.

California Joint Convention Plan.—A gathering which is to include the three important electric associations in California is scheduled to be held at Del Monte on April 22-28. The Pacific Coast Electrical Supply Jobbers' Association will convene early in the week and later join with the California Association of Electrical Contractors and Dealers and the Pacific Coast Section, N. E. L. A. One day will be devoted to the discussion of war emergency measures and another day to a discussion of commercial problems. Plans are to be discussed for the formation of a manufacturers' section of the N. E. L. A.

Illinois Contractors Adopt National Organization Plan.—At its annual convention in Chicago Feb. 22 and 23 the Illinois Electrical Contractors' Association went out of existence and was succeeded by a new organization known as the Illinois State Association of Electrical Contractors and Dealers. The new association, which adopted without discussion the form of constitution and by-laws prescribed by the National Association of Electrical Contractors and Dealers, turned over its entire membership of sixty-six and its funds, amounting to about $400, to the new body. The meeting was notable as the first Illinois contractors' convention at which there were no closed sessions and all branches actively participated. Among those who addressed the meeting were E. M. Craig, secretary of the Associated Building Contractors of Illinois; William L. Goodwin of the General Electric Company, who is the guiding spirit of the trade movement for better merchandising; George B. Foster, assistant to president of the Commonwealth Edison Company; John G. Learned, assistant to vice-president of the Public Service Company of Northern Illinois; George H. Hughes, president of the Edison Electric Appliance Company; A. J. McGivern of the Manhattan Electric Supply Company; Perry R. Boole of the Electric Appliance Company; W. R. Johnson, secretary-treasurer of the Wisconsin Contractor-Dealers' Association, Madison, Wis.; John A. Piepkorn, state secretary of the Wisconsin Contractor-Dealers' Association, and L. A. Schwab of the American Electric Supply Company. Officers for the ensuing year were elected as follows: State chairman, J. A. Weishar of Rock Island; secretary-treasurer, L. B. Van Nuys of Peoria; assistant secretary, G. A. Engelken of Chicago; district chairmen, R. W. Poelma of Chicago, E. F. Pendergast of Rockford, A. J. Hebel of Peru, J. A. Weishar of Rock Island, W. S. Savidge of Macomb, L. B. Van Nuys of Peoria, J. Hughes of Champaign, John Haenig of Springfield and Edgar Rice of Alton.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Faulty Installation.—Maintaining an electric light and power plant transmitting 33,000 volts over wire constructed above a public road without ammeter, circuit breaker or ground detector is negligence little, if any, less than criminal, and the operators must be held to have anticipated severe shock or death from breaking of wire without shutting off the current, the Court of Civil Appeals of Texas held in Abilene Gas & Electric Company versus Thomas (1985 W. 1027).

Regulation of Municipal Utilities.—Under the public utilities act providing that no plant owned or operated by a municipality shall be deemed a public utility thereunder, the Public Service Commission cannot regulate water rates where the water system is owned by the city though operated by lessees, it was held by the Supreme Court of Oregon (168 P. 939). Whether it is good or bad policy to exclude water systems owned by cities and operated by lessees from the operation of the public utilities act is not a matter for the courts.

Injuries from Failure to Provide Safety Appliances.—Electric companies are bound to use the highest degree of care practicable to avoid injury to every one in lawful proximity to their wires, including their employees, and to know what safety appliances are suitable and in ordinary use for the protection of employees working in proximity to currents which may prove fatal, the Supreme Court of Pennsylvania held in Donnelly versus Lehigh Navigation Electric Company (102 A. 219). When a particular safety appliance has come into general use by others in same line an electric company must furnish its employees with the protection which the appliance affords. Where an electric company fails to furnish an employee with the safety appliances in general use, the employee, having no knowledge of their existence, does not, as a matter of law, assume dangers which would have been obviated by their use, unless they are so apparent and imminent that no reasonable person would risk them; and in such case the employer assumes the risks of the situation. In an action of damages for the death of a lineman engaged in connecting insulated live wires, held, on the evidence, that his assumption of risk of danger from the wires, where he was working without certain safety appliances, was a question for the jury. An employee of an electric company connecting live wires without shutting off the current, as was the practice and custom in such work, and without a safety appliance in general use, was not guilty of contributory negligence.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Lighting of Y. W. C. A. Hostess Houses.—The Judge Advocate General of the army has rendered an opinion that the appropriation for furnishing heat and light for buildings erected at private cost under the act of May 31, 1902, is not available for furnishing heat or light for hostess houses of the Young Women's Christian Association.

Western Association of Electrical Inspectors Memphis Meeting.—The report of the Memphis meeting of the Western Association of Electrical Inspectors published in the ELECTRICAL WORLD of Feb. 9, 1918, inadvertently used the words "National Electrical Safety Code," whereas the word "safety" should have been omitted, as the requirements in question are part of the National Electrical Code. The Western Association of Electrical Inspectors indorsed the National Electrical Safety Code and will co-operate in its enforcement during the trial period.

Cleveland Electric Illuminating Company Increases Stock.—The Ohio Secretary of State has authorized the Cleveland Electric Illuminating Company to increase its capital stock from $15,000,000 to $18,000,000. Vice-president Robert Lindsay stated that the $3,000,000 will form a new series of preferred stock drawing dividends not to exceed 4 per cent. The company at present has $14,000,000 common stock and $800,000 6 per cent preferred stock, with $200,000 preferred stock yet unissued. No plans have been made for the sale of the stock.

Facilitating Franco-American Technical Relations.—*La Technique Moderne*, which gives the best known scientific and industrial French reviews, discontinued publication for a time because of the war. Readers of the ELECTRICAL WORLD will be interested to know that this journal has resumed publication. Capt. Gustave P. Capart, who visited this country some months ago as a member of the special commission from the French government, writes that M. Painlevé, former president of the Council, sees in the rehabilitation of this publication the means of facilitating technical relations between the United States and France.

Private Interests and Public Rights.—In handing down a decision to the effect that the Cleveland Railway must pay for paving on Superior Street viaduct, and thus sustaining the claims of the city of Cleveland and affirming the decision of the Court of Appeals, Judge R. M. Wanamaker said: "In this day private interests and private rights must yield to the public interests and public rights, and where there is an ambiguity or uncertainty as to which of two constructions should prevail in a franchise contract it is clear that the construction should be adopted by the courts that would be most favorable to the public interest and welfare."

Cleveland Rate Hearing.—The hearing on the appeal from the Cleveland 3-cent light rate ordinance has been resumed before the Ohio Public Utilities Commission. F. W. Ballard, employed as city expert engineer, declared that cost of production and distribution by the company has decreased steadily. Objections were made to an allowance of a return of 8 per cent on the valuation. The witness said that 7 per cent is considered fair and reasonable in all parts of the country. The company's claim for 3 per cent depreciation on all items was also attacked. Land, Mr. Ballard said, appreciates constantly and no allowance for depreciation should be made on it.

Consolidation of California Properties.—The Southern Sierras Power Company has joined with the Corona Gas & Electric Light Company, the Bishop Light & Power Company, the Rialto Light, Power & Water Company and the Coachella Valley Ice & Electric Company in asking the California Railroad Commission for authority for the last-named four companies to sell their properties to the Southern Sierras corporation. The prices of these properties are: Corona property, $135,914; Bishop company, $60,576; Rialto company, $24,915, and Coachella company, $821,687. The Southern Sierras company proposes to assume the obligations and pay the difference in cash. The Southern Sierras company is now selling these concerns all the electric energy they use, so that the purchase is the merging of the electricity manufacturing interests with the distribution interests.

Fuel Administrator Urges Water-Power Development.—Prof. D. M. Folsom, Pacific Coast Petroleum Administrator for Mark L. Requa, United States Oil Administrator, has issued a statement to the effect that the total power requirements of the Pacific Coast increase from 10 to 15 per cent per annum. At the present rate of oil consumption (110,000,000 bbl. per year in California) the reserve is not sufficient to supply long the demand, which now considerably exceeds production. At present approximately 20 per cent of the total power utilized on the Pacific Coast is developed from water power, while 70 per cent is obtained from fuel oil and natural gas. Taking into account various angles of the situation, the administrator states: "With the output of oil barely maintained or declining each year this increase must be entirely met through the development of more hydroelectric plants on the Pacific Coast. A conservative estimate of further requirements shows that the installed generating capacity of the plants now on the Pacific Coast should be doubled in five years and tripled in eight years to meet the local requirements for purposes of power, light and heat."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Denial of Increased Rates in Indiana.—The Indiana Public Service Commission has entered an order in the case of the Clay City Lighting Company, which sought to increase rates. The commission denied the petition, because of the financial showing made.

Incorrect Accounting.—The Indiana Public Service Commission has issued the following warning to utility companies that adopt incorrect methods of accounting: "Frequently a utility will fail to maintain a depreciation fund and while permitting its original property to depreciate will make extensions or additions out of so-called surplus income and then seek to capitalize these extensions and improvements, when the moneys so expended should have been set aside as a depreciation reserve, which legally is not susceptible of capitalization. This practice by utilities of setting up a fictitious book depreciation and ignoring proper depreciation debits against this account can only result in the commission taking such steps as will effectuate a complete and substantial obedience to the specific depreciation provisions of the act. In cases where the practice has continued the commission will naturally, for rate-making purposes, make such deductions from operating expenses as may be found proper and sufficient to cover a reasonable depreciation reserve."

Relief in Rates.—The California Railroad Commission has established new gas rates to be charged by the Western States Gas & Electric Company in its Eureka division. The company asked for only sufficient increase to offset higher cost of oil, materials and labor, and not for any increase in its rate of return. The commission says: "The commission realizes the difficulty under which public utilities are laboring on account of the present abnormally high cost of labor and materials of all kinds and is desirous of affording them such relief as appears to be fair and reasonable under all the circumstances. The utilities, on the other hand, should, of course, not expect the public to bear all the burden of such abnormal conditions, and in the present instance the company, recognizing its obligations in this regard, only asks for enough revenue to cover increased cost of oil and labor and taxes and does not expect any increase in its return on the value of its plant, although the rate of such return which it has hitherto received is considerably less than what might be considered a fair return under normal conditions. The rates herein established are calculated to accomplish approximately the result applied for."

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Leroy P. Sawyer, formerly general manager of the Buckeye Electric Division of the National Lamp Works of the General Electric Company, has left to take up special work in the executive department of the National Lamp Works at Cleveland.

T. H. Soren, who became connected with the Hartford Electric Light Company in 1916 as assistant to the vice-president, has been elected vice-president in charge of construction. Prior to going to Hartford Mr. Soren was for twenty-three years with the General Electric Company.

N. A. Boynton has been promoted from publicity manager of the National Lamp Works to general manager of the Buckeye Electric Division of the National Lamp Works, succeeding Leroy P. Sawyer. Mr. Boynton was born in Minneapolis in 1885. His early connections were with several Chicago printers in publication work and later with C. H. Hoelting, laboratory supplies, and with the Western Electric Company. He later attended the University of Illinois, from which he was graduated in 1909. Since that time he has been connected with the National Lamp Works in the engineering and publicity departments. He has been manager of the publicity department for the last six years.

N. A. BOYNTON

J. E. North, formerly commercial manager of the Springfield (Ohio) Light, Heat & Power Company, has been appointed secretary of the Springfield Chamber of Commerce. Mr. North has been identified with the Springfield Light, Heat & Power Company for the last eight and one-half years. He started as a salesman for the company and was promoted to the position of commercial manager several years ago. Mr. North entered the electrical field in 1903 with a local traction company and later was appointed electrical engineer of the road. Five years later he joined the force of the Robbins & Myers Company in Springfield and in the following year became connected with the local lighting company.

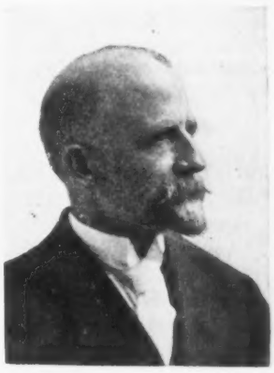
C. E. Groesbeck, formerly vice-president and general manager of the Utah Power & Light Company, with headquarters in Salt Lake City, vice-president of the Utah Light & Traction Company and vice-president of the Western Colorado Power Company, has returned to New York and has been elected a vice-president of the Electric Bond & Share Company. In his new position Mr. Groesbeck will have general supervision over the operating department of that company.

W. W. Briggs, who has been general agent of the Great Western Power Company at San Francisco since 1913, has resigned that position to become manager of the New York division of the Westinghouse Lamp Company. Previous to affiliating with the Great Western Company, Mr. Briggs was Pacific Coast manager of the Westinghouse Electric & Manufacturing Company. Mr. Briggs entered the industry in 1886 as a boy in the arc-lamp department of the California Electric Light Company. He was later connected with the Electric Improvement Company and from 1893 to 1896 was electrician for an Idaho mining company. He then joined the sales force of the Fort Wayne Electric Company. In 1899 he entered the sales department of the Westinghouse company and six years later became Pacific Coast manager. In 1911 he was appointed assistant sales manager of the Westinghouse company, with headquarters at San Francisco.

J. Parke Channing was elected chairman of the Engineering Council at the annual meeting held Feb. 21. Mr. Channing was born in New York City and was graduated from Columbia University with the degree of engineer of mines and master of science. Since graduation he has been engaged in mining, in Lake Superior iron and copper mines at first, and afterward in Montana, Utah and Tennessee, more particularly in copper. In 1900 he developed and equipped the Tennessee Copper Company and a few years later built one of the largest sulphuric-acid plants in the world to utilize the waste gases from its copper furnaces. In 1907 he discovered and developed the Miami copper mine in Arizona, now producing copper at the rate of 60,000,000 lb. per annum. He is also engaged in prospecting and developing new mines for the General Development Company. For three years he was president of the Mining and Metallurgical Society of America and is now its vice-president. He is a life member of the Aero Club of America. He was one of the founders of the Lake Superior Mining Institute and is one of its past-presidents. He was directly responsible for the founding of the Michigan College of Mines. He is a member of the American Institute of Mining Engineers and was one of its vice-presidents for the years 1908-1909. He is vice-president of the Miami Copper Company and of the General Development Company, managing director of the Utah Consolidated Mining Company and director of the Tennessee Copper & Chemical Corporation, the Kerr Lake Mining Company, the South America Gold & Platinum Company and other mining companies.

Obituary

E. W. Stevenson, a well-known cable engineer, was one of the victims of the Florizel disaster. Since the war began Mr. Stevenson had been engaged in supplying the British government with insulated wire and cable and recently more especially with storage batteries. It was on a trip to Newfoundland in connection with British government business that Mr. Stevenson lost his life. Mr. Stevenson, who was of English birth, comes from a family well known in the electrical industry, his father having established a considerable reputation as a submarine cable engineer in England. From 1880 to 1886 Mr. Stevenson was in the employ of the Telegraph Construction & Maintenance Company of London, England, and for two years thereafter was with the Commercial Cable Company. In 1889 he took charge of the cable circuits of the Old Brush Electric Illuminating Company of New York. In the early nineties he was engaged as a consulting engineer for two years and later spent four years as an electrical engineer with the Okonite Company. He left this company in 1899 to become connected with the Hazard Manufacturing Company, which at that time began the manufacture of insulated wire. He continued with that company, of which he was electrical engineer until late in 1913, when he resigned to become sales agent for Messrs. Smith & Nicolls, manufacturers of waxes. He leaves a large family, and his eldest son is a lieutenant in the Aviation Corps.



E. W. STEVENSON

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

JOBBING BUSINESS TOTAL ESTIMATED AT $150,000,000

Increase in 1917 Over 1916 30 to 33 per Cent in Value and Not More than 15 per Cent in Volume of Merchandise

Estimates on electrical jobbing business in the United States from a source known to be well in touch with the industry all over the country place the annual total at $150,000,000. The increase in jobbing business in 1917 over the previous year amounted to between 30 and 33 per cent in value as nearly as can be estimated. During the same period the increase in volume of merchandise handled probably did not exceed 15 per cent. The difference, of course, is represented by the increased cost of merchandise. A conservative estimate on the increase in the jobbing business for the last ten years by the same authority is 60 per cent.

LUBRICANTS AND OILS RAPIDLY ADVANCING

Sale of These Commodities to Public Utilities Increases 50 per Cent—Market for Them Is in Chaotic Condition

The raw material—that is, crude oil—from which the great majority of machine lubricants are derived is not only high but is becoming scarce, refiners say. At least, it is not so easily obtainable as it was even a year ago. With a continually advancing market, the latest increase within a week, 25 cents a barrel, brings crude up to $4 a barrel for Pennsylvania oil. There has also been an increase of 36 per cent on Southwestern crude. As one of the best known refiners or manufacturers explained the situation to the ELECTRICAL WORLD this week, an abnormal demand on crude stocks has drawn the reserve down rapidly. Last year 30,000,000 bbl. were taken from storage for domestic consumption; 50,000,000 bbl. were exported, 7,000,000 bbl. were imported and placed in storage.

Nevertheless, with apparently heavy stocks in various parts of the country, the danger line of insufficient crude for refining into lubricants and for other commercial purposes is not far off at the present rate of consumption, it is held. For transformer and other oils, which must be of the highest grade, for motors, dynamos, generators, turbines, and in fact all electrical machinery, prices are not only high but are constantly advancing. The last increase occurred two weeks ago, when 10 per cent was added. The supply of wood barrels is growing short, labor is difficult to retain, and the cost of delivery, declare refiners, is another controlling factor in to-day's refined-oil market. Manufacturers report great difficulty in securing proper quantities of oil to fill transformer orders. This situation is mostly due, it was said, to rail embargoes. The government is taking tremendous amounts of crude for fuel oil. In truth, its requirements dominate the oil market; or, as one representative refiner phrased it, oil will win the war. In 1915 crude oil sold at 9 cents. Now it sells for 20 cents, and at least 100 new refineries are under construction. Turbine and transformer oils absorbed at least 10 per cent of the surplus stock of crude oil. There is a comparatively easy market, deliveries are better, and government control would be an advantage. Further, according to the same authority, there has been fully 50 per cent increase in the sale of various fine oils for use by public utilities. Still another lubricant manufacturer stated that there had been from 10 to 50 per cent increase in the demand for electrical machinery oils and that deliveries were too impossible even to talk about.

NOTICE OF PROPOSED PURCHASES FOR NAVY

Quotations Called for on Miscellaneous Electrical Supplies for Mare Island Yard—Telephones for Philadelphia Yard

Bidders desiring to submit proposals for the following electrical material should give the schedule numbers desired and forward same without delay. Applications will be filed as soon as the schedules are received from the public printer. Schedules can be obtained upon application to the navy purchasing office in or near to each navy yard.

Article	Quantity	Navy Yard	Schedule No.
Annunciators, water-tight	13	Mare Island, Cal.	1707
Bells, vibrating, water-tight; non-water-tight; buzzers	Miscellaneous	Mare Island, Cal.	1707
Carbon, plate, 12 by 12, ¾ in. to 1¼ in. thick	160	Mare Island, Cal.	1707
Cloth, insulating, mica	50 lb.	Mare Island, Cal.	1707
Condulets with wire porcelain covers	250	Mare Island, Cal.	1705
Knobs, porcelain, solid	3200	Mare Island, Cal.	1705
Mica, plate, pressed, 18 in. by 36 in.	540 lb.	Mare Island, Cal.	1707
Mica, India, select, uncut	100 lb.	Mare Island, Cal.	1707
Paste, soldering, electric, non-acid	700 lb.	Mare Island, Cal.	1707
Plugs, attachment	2000	Mare Island, Cal.	1707
Receptacles, porcelain	2300	Mare Island, Cal.	1705
Rheostats for motor field	15	Mare Island, Cal.	1707
Rubber, hard, rod, sheet	80 lb.	Mare Island, Cal.	1707
Sets, ventilating for hull ventilation, 1000 cu. ft.	2	Mare Island, Cal.	1706
Sets, ventilating, portable	30	Mare Island, Cal.	1707
Sockets, keyless, brass	600	Mare Island, Cal.	1707
Sockets, pull	1500	Mare Island, Cal.	1707
Switches, knife	356	Mare Island, Cal.	1707
Switches, snap, non-water-tight	900	Mare Island, Cal.	1707
Tape, lino No. 10, ¾ in. wide insulating tape	Miscellaneous	Mare Island, Cal.	1707
Telephones, fire control	500	Philadelphia, Pa.	1717
Zincs, crowfoot	400	Mare Island, Cal.	1707

ELECTRICAL EXPORTS FOR THE MONTH OF NOVEMBER

Figures Again Pass Five-Million-Dollar Mark, Bringing Total for First Eleven Months of Last Year Almost to $50,000,000

Figures on electrical exports show shipments from the United States for November last to have amounted to $5,374,117, in comparison with $4,421,535 for the corresponding month of 1916. In spite of all the handicaps in export shipping, including government licensing and lack of tonnage, the exports for November last of electrical goods were the second largest in the history of the industry. Wire, cable and wiring supplies reached a total of slightly less than $1,000,000, while batteries went to more than $400,000 and motors to more than $600,000.

For the first eleven months of the year 1917, the total value of electrical exports was $49,761,700, in comparison with $35,497,238 for the first eleven months of 1916 and $22,164,250 for the same period of 1915. From the accompanying table, which has been prepared by the Bureau of Foreign and Domestic Commerce, it will be noted that during the first eleven months of 1917 the exports of every article listed were greater than those for the corresponding period of 1916.

Articles	November 1916	November 1917	Eleven Months Ended November 1916	Eleven Months Ended November 1917
Batteries	$308,005	$409,968	$1,812,793	$3,253,736
Carbons	.....	94,699	.....	558,150*
Dynamos or generators	182,653	164,179	1,561,806	2,078,330
Fans	21,169	33,361	290,349	549,967
Heating and cooking apparatus	.....	48,596	.....	197,832*
Insulated wire and cables	725,503	713,533	4,312,845	6,511,300
Interior wiring supplies, including fixtures	55,069	241,265	790,907	1,271,374
Arc lamps	731	732	14,321	14,884
Carbon-filament lamps	14,492	7,541	108,479	163,881
Metal-filament lamps	121,623	285,814	1,291,915	2,540,475
Magnetos, spark plugs, etc.	.....	433,704	.....	1,429,321*
Meters and measuring instruments	76,272	128,869	781,409	1,017,739
Motors	410,211	621,845	4,405,879	5,754,387
Rheostats and controllers	.....	10,783	.....	71,971*
Switches and accessories	.....	219,302	.....	768,981*
Telegraph apparatus, including wireless	54,562	24,099	193,689	511,059
Telephones	189,923	228,554	1,512,862	1,934,075
Transformers	72,496	271,016	964,798	1,534,641
All other	2,188,826	1,436,257	17,455,186	19,589,600
Total	$4,421,535	$5,374,117	$35,497,238	$49,751,700

*Figures cover period beginning July 1.

METAL MARKET SITUATION

Agitation for a Higher Price on Copper—Wire in Active Sale—Tin and Aluminum Scarce

Agitation to secure an increase over 23.50 cents for copper—the established official price up to May 31—is again being commented upon. There seems to be a sufficient supply of the metal to meet all requirements—foreign, governmental and for domestic commercial needs. Wire manufacturers for jobbing and ordinary trade demands are still figuring on a 30-cent base. A lower figure is only quoted for a prospective heavy order. Business in all wire products is very active, especially in large sizes.

Tin is high and scarce with very little Straits to be had at even the high figures quoted. The metal has now been placed by the government with the American Iron and Steel Institute as consignee for all importations.

Orders were issued on Feb. 28 commandeering, for war purposes, all crude and unworked platinum in the hands of importers, jobbers and wholesalers. This step was made imperative by the increasing need for platinum in the production of munitions. The latest quotation on the metal is reported at $110 an ounce.

Announcement was made Monday by the War Industries Board that President Wilson, after investigation by the Federal Trade Board as to the cost of production, has approved an agreement made with the producers of aluminum fixing a maximum base price of 32 cents a pound at the various American plants and their subsidiaries, subject to revision on June 1; such price to cover lots of 50 tons and over of remelt ingots of a grade 98 to 99 per cent. The differentials now in force for the different grades, quantities and shapes will continue in force for new contracts.

NEW YORK METAL MARKET PRICES

	Feb. 25 £ s d	March 4 £ s d
Copper:		
London, standard spot	110 0 0	110 0 0
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	*27.00	*27.00
Lead, trust price	7.00	7.25
Nickel, ingot	50.00	50.00
Sheet zinc, f.o.b. smelter	15.00	15.00
Spelter, spot	7.92½	7.77½ to 7.82½
Tin, Straits	*85.00	*85.00
Aluminum, 98 to 99 per cent.	35.00 to 37.00	Govt. price 32.00

OLD METALS

Heavy copper and wire	21.50 to 22.00	21.50 to 22.00
Brass, heavy	14.00 to 15.25	14.00 to 15.25
Brass, light	10.00 to 10.50	10.00 to 10.50
Lead, heavy	6.25 to 6.50	6.25 to 6.50
Zinc, old scrap	5.50 to 5.75	5.50 to 5.75

*Nominal.

THE WEEK
IN TRADE

REPORTS confirm the general impression that each month from the opening of the year records larger sales and increasing values in the volume of business in electrical equipment and staple merchandise. In this respect February goes ahead of January, and it is expected that March will score a still higher mark. The demand for goods, particularly motors and other apparatus, floodlamps, conduit, rubber-covered and weatherproof wire for army cantonments, shipyards and allied industrial enterprises, is exceedingly heavy and is running into millions of dollars. Domestic specialties and appliances, such as refrigerators, sewing machines, washing machines, vacuum cleaners, etc., are moving rapidly. The demand and shortage of lamps is abating. Deferred shipments and rail deliveries are still disturbing elements but are gradually becoming better.

For February collections are reported from fair to the best on record. Credits are being carefully watched and the "loose rein" is not visible in any part of the country.

NEW YORK

With improved weather conditions and a decided relief in shipments and deliveries, trade in electrical goods has bettered greatly. Distributing agencies and jobbing houses are in a stronger position regarding stocks and report larger sales, with a demand for staples in particular. The announcement of the new discounts on heating appliances, published exclusively in last week's ELECTRICAL WORLD, came as a surprise to jobbers, dealers and central stations.

Collections continue to be fairly satisfactory, if not altogether prompt, and vigilance is exercised in the examination of credits.

ELECTRICAL TOYS.—The selling season, which opened Jan. 1 and closes about the end of March, has so far been excellent. As a matter of fact, reports from the leading manufacturers say that the buying of electrical toys exceeds last year's record greatly in volume and value. It appears also that very few new contrivances were brought out as compared with former years. Prices were increased about 5 per cent about the first of the year, and no further advances are expected. Shipments of goods will be made on contract stipulations and, according to trade custom, deliveries will be completed in September. From then to the midwinter holidays the buying will be of the filling-in order.

GEARS AND PINIONS.—Deliveries are about three or four months back, but conditions are slowly improving. Prices are not softening, and manufacturers' sales agents would not be surprised if an advance were made. Raw material is getting easier and the demand is active. In this market several large orders have recently been filled.

DRY BATTERIES.—The supply is referred to as only fair by leading primary distributers and jobbers. No revision of prices has occurred.

HEATING APPLIANCES.—It is evident that a drive is on in the sale of flatirons, toasters, grills, pads and radiators. This applies more especially to prominent department stores, which are having their annual sales this month on these lines.

LAMPS.—A shortage in all sizes is complained of by jobbers. A manufacturer figuring largely in the trade stated shipments had been somewhat delayed, owing to the embargoes and freight congestion. As a matter of fact there was no shrinkage in the actual supply so far as the factory was concerned. Stock in the sectional or local warehouses had been depleted by an unusual drawing upon the reserve. Orders are now being filled and deliveries made

direct from the factory, and consequently it is expected that the apparent shortage will soon be caught up with and disappear.

HOUSEHOLD SPECIALTIES.—Sales on sewing machines, washing machines and vacuum cleaners are running into large volume. The selling campaign inaugurated by the makers and distributers, now in vigorous swing, are having very satisfactory results.

SOCKETS.—Standard and special lines are said to be steady with no change in price or supply.

WIRING FIXTURES.—The market is very uncertain owing to natural conditions, which may brighten under the presence of better weather and improved deliveries.

CONDUIT.—Jobbers report that on some sizes there is a decidedly low stock. Shipments are still held up between Pittsburgh and Eastern territory points. As one distributer explained, owing to the difficulty of getting some sizes of iron conduit a higher charge may be made for immediate delivery. In such cases prices are quoted prior to shipping.

ELECTRIC FANS.—From all accounts it looks as if the sale will be the largest on record. Manufacturers are putting out publicity campaigns for reaching the ultimate consumer, and these efforts are already having their effect upon the trade, which is preparing for a wide public demand in the regular season.

SMALL MOTORS.—Deliveries up to 20 hp. and 30 hp. are more definite, but with no price change.

COLLECTIONS AND CREDITS.—There is no marked change in the status of collections. Jobbers, as a rule, say they are up to a high average mark. Credit men are not relaxing their care in scrutinizing orders on time accommodations. Short terms are the rule.

BRUSHES.—Ceylon graphite, of the best grade, once scarce, on account of the British embargo, is somewhat easier. Deliveries are prompt, going out by express and parcel post.

CHICAGO

Some men of prominence in the trade in Chicago, basing their judgment on the business of the last two months and on the future outlook, see an electrical supply business for 1918 of only 50 to 75 per cent of last year's volume. January with most of the jobbing houses was bad. To weather conditions and heatless days this condition is attributed. In nearly every instance February was better by comparison than January, in spite of the disadvantage under which all firms worked. One house reports that February, 1918, was ahead of February, 1917, but this condition is not general. Optimism as to spring business is general. There have been no changes in prices during the last week. Stocks are in good condition, and no shortage of material in addition to those already existing is foreseen.

The trade for the last week has been greatly concerned with the drive for the war camp recreation fund. The offices of several jobbing houses and manufacturing plants have been personally engaged in soliciting subscriptions from firms in the trade.

CONDUIT.—Deliveries are getting better. Manufacturers are managing to ship some conduit into the city, and this has relieved the jobbing situation.

LINE HARDWARE.—This is the season when jobbers usually stock up on line hardware. Some are buying and some are not. Those who laid in extraordinarily heavy stocks last fall in anticipation of the usual sleet-storm damage have some of it still on hand and are not in the market.

DOMESTIC REFRIGERATORS.—There is activity in this line that indicates some real developments shortly. Manufacturers who have been eminently successful in marketing other electrical goods are viewing the electric refrigerator as a load-building device that can be installed without additional central-station expenditure. A device of this kind that can be sold at a reasonable price has been promised to the trade.

FIXTURE PARTS.—Business in this line, following the slowing up of building activities, is poor.

PORCELAIN INSULATORS.—Standard stock goods are holding up well, owing to jobber purchases, but a slowing up in the larger goods is noted. Six weeks are quoted on standard stock goods; eight weeks on 33,000-volt goods, and on the larger units longer deliveries are quoted. Practically all of the factories have enough work on hand to keep them busy for six months. No price changes are anticipated.

CEDAR POLES.—Producers are seeking Chicago connections to distribute cedar poles.

BOSTON

Business continues in large volume, although in many lines the total sales are still below those of the early winter. In response to good merchandising methods, increasing sales of heating appliances are reported in retail circles. Prices are firm, with no immediate changes forecast. Collections are a little slower, but the situation is not at all disquieting. Stocks are fairly large in most lines except conduit, heavy wire and large motors. Some improvement begins to be seen in deliveries. The labor situation is better.

Slowly but surely the electric railways bid fair to reenter the electrical material market, a most encouraging sign being a special message of Governor McCall last week urging higher fares for the Boston system during the period of the war. Maintenance has been sorely neglected of late on many of the electric roads, and manufacturers and jobbers are bound to obtain more business from traction customers this year unless all signs fail.

Electrical manufacturers are suffering from the draft, but vigorous efforts are being made to train employees for increased responsibilities. The relaxation of some of the New England fuel rules this week means longer hours of business and increased consumption of electrical supplies. March will be a full-time and over-time month, and the industrial outlook is far ahead of that of February.

HEATING APPLIANCES.—Retail sales are spotty, but the public seems to be coming into the market more than of late for table appliances. A large Boston department store reports very rapid turnovers in its electrical heating stock, with irons moving fast. A healthy demand exists for percolators, toasters, heating pads and hot plates of small size. As compared with their midwinter attitude, central stations are waking up to the value of appliance business.

LAMPS.—The supply is rapidly increasing. Full-time factory operation is a decided factor in relieving the short stocks here and there reported. The demand for carbon lamps persists, but manufacturers are not encouraging its development and believe it will be short-lived.

MOTORS.—The situation shows little change compared with last week. Smaller sizes are coming more and more into hand, but long deliveries prevail in the larger units. Prices remain steady. Up to 50 hp. deliveries are generally improving and single-phase motors are now in good stock. While stock sheets in general show some gaps, buyers can approach the manufacturer now with greater confidence of being able to secure what is wanted within a reasonable period than for some months. Wooden shipyards are purchasing motors in good volume, but there is a slight lull in army and naval shipbuilding orders at the moment.

AUTOMOBILE SUPPLIES.—With the opening of the annual automobile show at the Mechanics' Building, March 2, a striking increase in interest in electrical supplies for automobiles was seen. Poor railroad service is turning many traveling men to consider car purchases for spring and summer business, and accessory dealers are sure to benefit. Batteries and lamps are very much in the public eye this week.

CONDUIT.—Larger sizes of pipe are still scarce and in great demand by munition plants and other war establishments. Seventy new buildings are being erected at the Watertown (Mass.) Arsenal, and this means a heavy local demand for wiring material and conduit. Delivery difficulties are receiving much thought, and it is believed that the improving railroad situation will show a better movement of pipe before long.

PORCELAIN FITTINGS.—Stocks are very low and railroad embargoes have caused much disquietude. The demand

for heavier wiring service is far beyond the available supply. Prices are holding tight.

FLOODLAMPS.—A fair business is being handled in connection with industrial plant extensions. It is likely that this business will grow somewhat this year as the supply of labor for outside work becomes diverted from one field to another.

ATLANTA

There is very little change in general conditions to record over last week, the undertone remaining strong in all lines. This section is pretty well assured that the government will not fix a price on cotton and this feeling has a tendency to strengthen confidence. Although nothing definite is known with reference to future steel prices, it is not expected that any material change will be made, and, if any, no reduction is looked for. In the face of this uncertainty industrial construction is moving along nicely. Quite a large number of new industrial enterprises have been incorporated in the Southeast this week which will call for considerable electrical equipment. Reports from Washington, D. C., indicate that approximately $5,000,000 will be expended at Camp Gordon for concentrating troops and supplies and for aviation purposes in Atlanta. Another large hospital is contemplated for Camp Wheeler, Macon, Ga. The erection of fifteen Liberty theaters at various cantonments has stimulated the demand for theatrical appliances. Shipment on this class of equipment has slowed up materially of late. Rumors have been afloat regarding big electrical developments by the large power companies in collaboration with the government. It is expected that more definite information will be available next week.

The dealers state that the advent of springlike weather has increased activity in household appliances. Local stocks are in pretty fair shape to take care of this demand. While residence construction has shown a slump, owing to publicity of the capital issues committee, contracting business is holding up well in the industrial and governmental fields.

INSULATORS.—The demand continues steady and no change in prices or deliveries is noted. In fact, the entire line of pole and line material has registered little change lately, the volume of sales being comparatively heavy.

INDUSTRIAL CONTROL DEVICES.—This line continues very active, especially in motor-starting panels and speed regulators. Drum controllers and resistances for wound-rotor alternating-current motors are also in good demand, but shipment promises are very discouraging.

SEATTLE

Total sales for February were considerably lighter owing to the short month, but the volume for the month averages favorably with January in proportion to the number of business days. Both jobbers and retailers report that the week's business has been maintained at the preceding week's volume. Floodlamps were the prime mover, these going to shipyards and new industrial plants. Sewing machines were the next best seller, the week's sales exceeding last week's slightly. Other domestic appliances are moving satisfactorily, with a noticeable increase in the sales of ranges and flatirons. The full movement of these will not begin for two months or more. Sales to shipyards were as heavy as within the past three weeks. Mill buying is lighter. The volume to cantonments is very light but is expected to increase when construction begins on the additional structures. The freight situation as it applies to local jobbers is no better. Shipments of appliances, conduit, motors, etc., are delayed en route or are waiting at the factories for cars. Shipyard work has not been retarded to any extent, because the concerns have priority certificates entitling them to the best service available.

Oriental freight congestion in Seattle is reduced from 6000 to 4500 cars. Collections for February were the best in years in spite of the short month. Credits are being placed carefully; very few new credits being placed during the month.

At present the housing problem for shipyard workers in Seattle is serious but not critical. If the situation hampers the government shipbuilding program the United States Shipping Board will use its commandeering power to provide living quarters. During the first two months of the year the building permits issued in Seattle totaled $710,056, compared with $265,480 for the same period last year. An additional unit to the five-hundred-thousand-dollar hotel at the American Lake cantonment, at a cost of $400,000, is announced. A contract was awarded for twelve structures increasing the capacity of the cantonment hospitals, of which the cost will be $262,000. Absolute control of the spruce industry in Oregon and Washington has been taken over by the government. Beginning March 1, the logging camps and lumber mills of both states established a basic eight-hour day. The British Columbia loggers' association will place an eight-hour day in effect March 11.

It is officially announced that the government stands by the formerly stated plan of adding thousands of skilled mechanics to the Seattle shipyards engaged in government work. The predicted movement will reach a heavy volume early in the summer. The transportation problem in Seattle to the shipyards is being greatly improved. It is assured that the solving of the transportation problem will result in the expansion of many industries and speed up the production of ships and other war necessities. The labor situation is slightly improved, but it is believed a tightening will follow the opening of spring work in the agricultural sections.

The lamp situation is relieved somewhat. Sales will decrease materially with the coming of longer days. Stocks are still low, prices are steady and the present demand is excellent. The motor supply is better, but the demand is less. Stocks are still depleted by recent orders for extensions and betterments in the shipbuilding and industrial field.

SAN FRANCISCO

With all fear of a serious drought past, a note of buoyant optimism pervades the California electrical industry. There is plenty of business, even though a great deal of it lies in channels which have been heretofore practically uncharted. While official February reports have not been tabulated, it is clear that the number of building permits and the total value of the jobs involved fall considerably below the pace set in January. Few hotel and apartment jobs have been recorded, and work on private dwellings is mostly confined to rewiring and small additions. The bulk of the permits issued in San Francisco, which may be taken as a fair example of Pacific Coast conditions, cover industrial buildings.

The past week has seen some very large orders from shipbuilding plants covering big rubber-covered cable, large-sized conduit and condulets, high-amperage motor-starting switches and large fuses. To acquire speed and accuracy a variety of ingenious mechanical devices are used which are motor-driven, hence an unprecedented demand for circular-mill rubber-covered wire which has exhausted the local stocks.

LAMPS.—Deliveries are easier, and lamp salesmen who have been harassed for many weeks past by demands which conditions rendered impossible to fill are now willing to admit that the worst of the situation is past. The volume of orders for the United States government, or for plants engaged in government work, continues at about the same high level, but it is no longer necessary to appeal to the dealers' patriotism and secure their consent to the diverting of their shipments to such plants.

HEATING DEVICES.—Surplus stocks carried over from an indifferent holiday season have cut dealers' purchases to a negligible demand, but a gradual sale of stock on hand, coupled with the usual spring business and the governmental plea for electrical devices, is expected to restore the tone. Many dealers are now soliciting the small heating-device business on a partial-payment scheme. This plan constitutes an innovation.

HOUSEHOLD APPLIANCES.—Although purchases of the smaller electrical household helps are curtailed, it is testimony to the far-sighted economy of a buying public that sales of such devices as washing machines and vacuum cleaners have doubled. Liberal credit terms are given by the electrical jobbers as an encouragement.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List to $61.00
Coil to 1000 ft	10% to 59.17
	No. 12 Solid
Less than coil	List to $71.00
Coil to 1000 ft	—10% to 68.87

Twin-Conductor

	No. 14 Solid
Less than coil	List to $105.00
Coil to 1000 ft	$70.00 to 10%
	No. 12 Solid
Less than coil	List to $135
Coil to 1000 ft	10% to $130.95

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	15% to + 20%
Coil to 1000 ft	20%
	No. 12 Solid
Less than coil	15% to 10%
Coil to 1000 ft	20% to 5%

Twin-Conductor

	No. 14 Solid
Less than coil	20% to $115
Coil to 1000 ft	—15% to $85
	No. 12 Solid
Less than coil	15% to + 20%
Coil to 1000 ft	—10% to 20%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10% to $24.00
1/5 to std. pkg	20% to 19.80
Std. pkg	34% to 18.75

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+ 10% to 12%
1/5 to std. pkg	20% to List
Std. pkg	28% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.3175-.3195	.3275-.3295
Barrel lots	.2875-.2895	.29.75

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, Per 100 Ft.
5/16	250	$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25–50	35.00
2	25–50	45.00
2 1/2	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp.	Net to $75.00	—15% to $69.75
3/8-in. d. stp.	+10% to 75.00	List to 72.00
1/2-in. s. stp.	List to 100.00	—15% to 93.00
1/2-in. d. stp.	+10% to 100.00	List to 96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75.00	$63.75
3/8-in. d'ble strip.	78.25 to 78.75	71.25 to 71.75
1/2-in. single strip	100.00	85.00
1/2-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32	$0.05 1/2	1	$0.25
1/4	.06	1 1/4	.33
5/16	.09	1 1/2	.40
1/2	.12	1 3/4	.47
5/8	.15	2	.55
3/4	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in. $25.00-$55.00	$20.50-$24.50	$20.00-$21.50
1/4-in.— $28.00-$60.00	$22.50-$27.00	$22.00-$23.50

NET PER 1000 FT.—CHICAGO

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in. $36.00-$55.00	$25.00	$22.50
1/4-in.— $40.00-$60.00	$27.00	$25.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4	$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37
2 1/2	.58 1/2
3	.76 1/2

	Couplings, List	Elbows, List
1/4	$0.05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	4% to 6%	7% to 9%
2500 to 5000 lb.	6% to 8%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	1.3%-4.7%	4.3%-7.7%
2500-5000 lb.	3.3%-6.7%	6.3%-9.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$6 00
Discount	30%

CHICAGO

List	$5.00 to $6.00
Discount	25% to 30%

FUSES, INCLOSED

	Std. Pkg.	List
250-Volt		
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	28%
1/5 to std. pkg	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	28%
1/5 to std. pkg	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.00 to $5.75
1/5 to std. pkg.	4.50

Standard package, 500. List, each, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard package, 500. List, each, $0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.30
60-watt—B	100	.35
100-watt—B	24	.70
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round bulbs, 3½ in., frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.77
Round bulbs, 4⅜ in., frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$24.90 to $31.00
Coil to 1000 ft.	22.72 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$29.00 to $30.00
Coil to 1000 ft.	21.50 to 33.50

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$20.00 to $29.00

CHICAGO

Net per 100	$19.17 to $24.00

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200 S.E., 300, AX, 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25%-37%	20%-32%
$10.00 to $50.00 list	42%-45%	37%-40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$20.00 to $38.00
1/5 to std. pkg.	19.00 to 20.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80
1/5 to std. pkg.	14.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500 5½ N. C.	Std. Pkg. 4000 —Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$27.50 to $29.00	$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

Per 1000 Net	Std. Pkg. 3500 5½ N. C.	Std. Pkg. 4000 —Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$11.85	$30.75
1/5 to std. pkg.	11.10 to 11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push		
⅛-in. cap key and push sockets.	500	$0.33
⅛-in. cap keyless socket.	500	.30
⅛-in. cap pull socket.	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net to $23.00
1/5 to std. pkg.	20% to 21.00

NET PER 100—CHICAGO

Less than 1/5 std. pkg.	24% to $25.00
1/5 std. pkg.	30% to 23.00

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	List to + 5%
$10 to $25 list	11%
$25 to $50 net	14% to 15%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16%
$25 to $50 list	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+5%
$10 to $25 list	10% to 11%
$25 to $50 list	—14%
	Low Grade
Less than $10 list	5%
$10 to $25 list	—16%
$25 to $50 list	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to —15%
Std. pkg.	List to 30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	List	Net
$2.00 to $10.00 list	10% to 20%	5%
$10.00 to $50.00 list	20% to 30%	15%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25%	15% to 20%
$2.00 to $10.00 list	25%	20%
$10.00 to $50.00 list	25% to 35%	20% to 25%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00
Discount	30%

CHICAGO

List price	$4.50 to $6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.44¼
No. 18, full spools	0.43¼

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.57 to $0.65
No. 18, full spools	0.47 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net—		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
11.	$15.00-$18.00	$13.00	$10.25-$11.50
12.	23.25- 25.41	21.30- 21.78	15.97- 19.35
10.	32.40- 35.21	29.70- 30.18	22.13- 27.00
8.	45.70- 49.12	41.90- 42.12	30.88- 38.00
6.	72.40- 77.84	66.35- 66.72	48.93- 60.30

CHICAGO

	Price per 1000 Ft. Net—		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14.	$18.00	$13.00	$11.50
12.	25.33-$26.28	22.02-$25.33	18.35-$20.93
10.	30.48- 36.54	27.94- 31.26	22.86- 29.23
8.	42.54- 51.57	38.99- 44.13	31.90- 41.36
6.	66.46- 88.38	56.15- 75.61	50.53- 70.70

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$33.25 to $35.25
25 to 50 lb.	31.25
50 to 100 lb.	28.25 to 34.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$35.42 to $40.35
25 to 50 lb.	34.50 to 39.35
50 to 100 lb.	33.42 to 38.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

CO_2 Indicator

The Dwight Manufacturing Company of Chicago has added to its line a second form of CO_2 indicator. The use of a mercury column calibrated to indicate directly the percentage of CO_2 is the distinguishing feature. The initial design, which is still retained, used a small spring-type gage for this purpose.

The instrument consists of the usual metal reservoir, a specially calibrated mercury gage and the carrying case for the complete outfit. When in service the reservoir is disconnected from the gage and a sample of flue gas pumped through the chamber. A comparatively large supply of potash solution fills the base, and on the surface of this solution floats a layer of mineral oil, sealing from the chemical the gas sample being collected. When the gas sample has been obtained both valves on top of the instrument are closed and the reservoir is shaken back and forth a few times to break the oil seal and allow the chemical solution to absorb the CO_2 from the gas sample. This "splash system" of mixing the gas and liquid produces rapid absorption of the CO_2 on account of the large surface area of fresh chemical brought in contact with the gas. Connection is then made with the mercury gage, and upon opening the communicating valve the percentage of CO_2 in the gas is indicated on the gage.

Duplex Switch

For controlling two independent lighting circuits from one point, the Bryant Electric Company of Bridgeport has designed a switch that can be used as a substitute for two separate single-pole flush switches requiring a two-gang switch box.

The device consists of two Perkins type "O" push-button switches mounted in a porcelain cup, each switch having its own line and circuit terminals, so that separate feeds for the two circuits can be brought into the switch.

FOR SINGLE-GANG BOX

The switch fits into any shallow single-switch box and takes the standard two-button plate.

This switch is specially advantageous where the public service company has a two-rate schedule. As the switch has separate feeds, a circuit at each rate can be passed through one box and controlled at the same point.

The new device, which is known as type O, duplex gang switch, No. 2709, is National Electric Code standard and is rated at 10 amp., 125 volts; 5 amp., 250 volts.

Ornamental Lighting Unit

An ornamental lighting unit with the novel feature of an illuminated glass canopy has been added to the General Electric Company's line. This unit differs from most of the ornamental units previously furnished in that the canopy covering the opening in the top of the globe, which permits the removal of the lamp inside, is covered with a glass instead of a metal canopy. This new canopy is made of

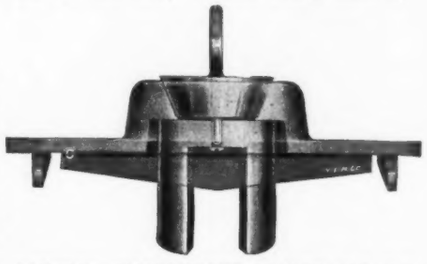
EQUIPPED WITH ILLUMINATED GLASS CANOPY

the same diffusing glass as the globe. It is pointed out that it adds wonderfully to the lamp's appearance, as it shows the outline of the complete fixture when illuminated.

Adapter for Snap Switches

A container or adapter for snap switches, to make them water-tight, is being placed on the market by the Barlow Electrical Specialties Company of Yonkers, N. Y., known as the Youmans water-tight switch box. Into one of these switch boxes the wireman may insert any make of snap switch, either 5-amp. or 10-amp., single-pole or double-pole, three-way or electrolier type. When renewal of the switch becomes necessary the switch box is filled with a stock snap switch.

The switch box consists of a cast-iron box drilled and tapped for the reception of conduits. Upon this is placed the cover, having the snap switch suspended on a yoke piece, the rubber handle of the snap switch being held by



PROVIDES WATER-TIGHT RECEPTACLE FOR SWITCH

an insulated clutch on the under side of the cover. This in turn is operated by the knob outside the cover through a conical-valve ground piece seated in the cover, thus avoiding rubber packing around the spindle as in most types of marine or water-tight switches. The cover is brass and is screwed to the box by four corner screws, with a rubber gasket between cover and box.

A round box is also made, 3½ in. (8.9 cm.) in diameter, the cover of which threads on like the cap on a water pipe, no rubber gasket being required. Both the square and round boxes are made in a larger size, adapted to receive any standard 20, 30 or 50-amp. switch. When filled with insulating oil the large round switch box with inclosed switch makes a low-priced oil-break switch especially suited for motor control in factories where no spark is permitted.

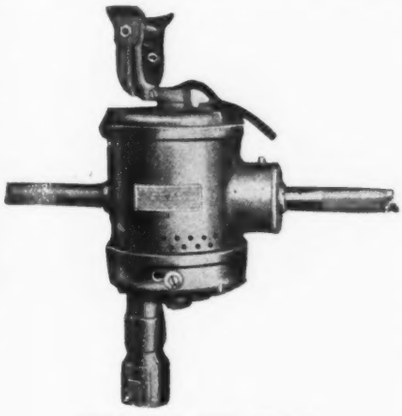
Motor-Operated Machine to Finish Cuts

The J. E. Richards Company of Kalamazoo, Mich., has developed a motor-operated machine for standardizing print-shop composing-room operations. The same machine buzz-saws, jig-saws, drills, touts, broaches, notches, undercuts and mortises electros, halftones, etchings, bases, "boilerplate" and linotype slugs. A swinging-jig saw arm is provided, permitting this part to be swung at right angles with the circular saw to permit material of any length being run through the machine.

The various devices on the table of the machine are belt-driven from a fractional-horsepower motor made by the General Electric Company. Energy is obtained from the lamp socket, and a proper motor is furnished to operate on the energy available.

Portable Electric Drill

A portable electric drill, which is manufactured by Gilfillan Brothers Smelting & Refining Company of Los Angeles, Cal., is equipped with gears to give two speeds. These are changed by means of a knob on the bottom of

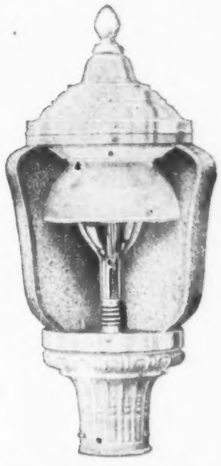


DRILL HAS TWO SPEEDS

the gear case. The gears themselves are made of chrome-nickel steel and run in grease. Ball bearings are used throughout. A ½-in. (1.27-cm.) standard chuck and a sturdy electric switch are provided. The speed range is 400 r.p.m. on low speed and 700 r.p.m. on high speed. Westinghouse motors are furnished.

Ornamental Lighting Unit

An ornamental lighting unit which diffuses the light with very little absorption and is of great value where low-candlepower lamps can be used, has been developed by the General Electric Company of Schenectady, N. Y. The stippled globe is in three sections, making renewal costs much lower than where a complete globe is used. This fixture can be furnished with or without dome refractor. In both cases there

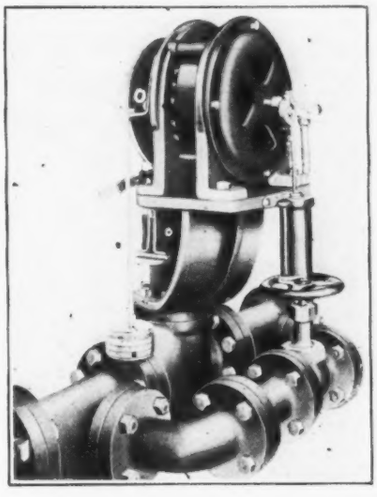


DIFFUSES LIGHT WITH LITTLE ABSORPTION

is enough light in an upward direction to illuminate the globe for its entire length. It is the only globe of a diffusing nature in which the refractor can be used to good advantage, especially with low-candlepower lamps, because it does not rob the light source of very much of its initial candlepower. When the refractor is used the lamps are of exceptionally high value for residential street lighting, because it collects all of the upward light and redirects it to the street surface away from the trees. The stippled glass globe is irregular on the inside, so as to split up the light rays and eliminate glare.

Grinder Regulator for Pulp Mills

To maintain a steady maximum output from electrically driven grinders in pulp mills the General Electric Company has developed a regulator which maintains a practically constant load on the grinder motors. The regulator maintains a practically constant load on grinder motors at any predetermined value, so that the current variations are held within such narrow limits that their influence on the electric system is practically negligible. This result is accomplished by automatically regulating the water pressure on the pockets



MAINTAINS MAXIMUM PRODUCTION OF ELECTRICALLY DRIVEN GRINDERS

by means of a motor-operated throttle valve.

The regulator consists of a small induction motor which is connected through series current transformers to the feeder lines of the grinder motor. The rotor of the regulator motor rotates through a small angle and actuates the throttle valve of the main water supply to the grinder, automatically reducing the water pressure when the load on the grinder motor starts to increase and conversely opening the throttle valve and increasing the water pressure to compensate for a falling load.

While this regulating device is simple and strong mechanically, it is also very sensitive to the load changes and smooth in its operation. Actual service tests show that with a single three-pocket grinder, with instantaneous changes in load as great as 33 1/3 per cent, the fluctuations on the driving motor feeder circuit did not exceed 2 per cent.

Variable-Speed Alternating-Current Fans

The Kimble Electric Company, 634 Northwestern Avenue, Chicago, has prepared for the 1918 season a line of variable-speed alternating-current fans. These variable-speed fans will be made

SPEED IS CONTROLLED THROUGH USE OF THE TWO CHAINS

up in sizes ranging from 18 in. to 30 in. (45.7 cm. to 76.2 cm.) in diameter. These fans are reversible and variable in speed from any speed from 100 r.p.m. to maximum speed of the fan.

The entire control of speed is obtained by two chains suspended from the fan, and a slight pull on either chain will either increase the fan speed or decrease it, and maintain it at whatever speed is desired. If the chain is pulled beyond the neutral position the fan will reverse and instantly be converted from an exhaust fan to an intake fan. The fan equipment is built interchangeable from 110 volts to 220 volts. These fans will be equipped with a very small transformer, enabling the use of a low-voltage motor. The custom of using a 110-volt or 220-volt motor, or even higher voltages, has brought about the breakdown of fan motors when working under adverse conditions, such as in kitchens or very dusty atmosphere. For this reason the fans will be fully inclosed, and by using low-voltage motors they will run quietly and will, it is said, be proof against breakdown such as is common with motors of higher voltage.

The fans will be equipped with ball bearings, which will require the minimum of attention and will insure the running of the fans when other bearings have become inoperative because of the accumulation of grease or dust in the oil.

The fans can be built for 25-cycle and 30-cycle circuits, with slight modifications, and maintain the same rate of speed as will be common with the 60-cycle fan. All the fans will be complete units in themselves and will be ready for mounting upon the wall, it being only necessary to run two wires to the fan and no external wiring or regulator wiring being required.

Trade Notes

W. R. OSTRANDER & COMPANY of New York City will represent the Hygrade Lamp Company of Salem, Mass., in the New York and Brooklyn territory.

GEORGE SIESS, who has been stores manager of the Cleveland office of the Western Electric Company, was recently appointed assistant manager of that office.

THE TRIANGLE CONDUIT COMPANY of Brooklyn, N. Y., announces the appointment of Alva D. Stein, 156 Purchase Street, Boston, Mass., as its New England selling agent.

THE LUX MANUFACTURING COMPANY of Hoboken, N. J., announces that it has been awarded the municipal contracts for lamps for both New York City and Chicago for 1918.

W. W. BRIGGS has resigned as general agent of the Great Western Power Company to become manager of the New York division of the Westinghouse Lamp Company, taking effect April 1.

STEPHEN A. STAEGE announces the dissolution of the firm of Staege & Dewey, and that he will continue in consulting engineering practice, with offices in the Light & Power Building, Watertown, N. Y.

NELSON P. HALL has been appointed district sales manager for the Chicago territory of the Van Dorn & Dutton Company. He was formerly connected with the sales force of the Elecric Service Supplies Company of Chicago.

RAYMOND W. MURPHY, who was until recently in charge of the Pacific Coast offices of the Westinghouse Electric & Manufacuring Company, East Pittsburgh, Pa., has been transferred to the Philadelphia office of the company, where he is assistant manager.

THE ILG ELECTRIC VENTILATING COMPANY of Chicago has purchased 214,282 sq. ft. of property in Chicago, involving the payment of approximately $128,570, and it is reported that the new factory building which the company will erect on the site will cost more than $600,000.

J. D. TODD, who until recently was connected with the Western Electric Company at Kansas City, Mo., as assistant sales manager, became associated with the Missouri Valley Electric Company, Jan. 1, as vice-president and manager. Mr. Todd will make his headquarters at Kansas City.

F. H. SMOCK, formerly commercial agent of the Eastern Wisconsin Edison Company, Sheboygan, Wis., has become a salesman with the Bryan-Marsh Division of the National Lamp Works, General Electric Company, in its Southern territory, consisting of Kentucky, Alabama, Tennessee, Mississippi and Louisiana.

THE GREENFIELD TAP & DIE CORPORATION of Greenfield, Mass., opened its new administration building March 5. This event is of more than ordinary importance to the company, as heretofore each plant has maintained its own office and shipping room. Now these functions are centralized in the new building, offering employment to 125 persons in the office alone.

VICTOR R. DESPARD has resigned as manager of the Chicago office of Pass & Seymour, Inc., Solvay, N. Y., to engage in the manufacture of electrical wiring devices, as Despard & Gordon, Inc., with headquarters in Chicago. Mr. Despard is widely known in the electrical industry of the Middle West. He entered the electrical business in 1906 as salesman for the Mohawk Electrical Supply Company and became associated with Pass & Seymour two years later.

SCHWEITZER & CONRAD, INC., of Chicago, Ill., has appointed R. L. Lunt district representative for the northern peninsula of Michigan, the States of Minnesota, North Dakota, South Dakota, the eastern portion of Nebraska, the western portion of Iowa and the northwestern portion of Wisconsin, with offices at Minneapolis and Omaha. The firm has appointed Charles Farnham district representative for the southern part of the State of California, with offices in the I. W. Hellman Building, Los Angeles. Both of these district representatives will handle the entire line of S. & C. high-voltage protective and switching devices.

THE WORTHINGTON PUMP & MACHINERY CORPORATION of New York City announces that the following appointments have been made, effective as of March 1: James E. Sague, vice-president, in charge of engineering and manufacturing; Leon P. Feustman, vice-president, in charge of general commercial affairs; Frank H. Jones, vice-president, in charge of sales; Edward T. Fishwick, general sales manager; Charles E. Wilson, assistant general sales manager; William Goodman, assistant to vice-president; William Schwanhausser, chief engineer. The offices of the foregoing will be at 115 Broadway. Neil C. Lamont, works manager, Laidlaw Works, with office at the works, Elmwood Place, Cincinnati.

Trade Publications

MOTOR-STARTING SWITCHES. — The Wells-Morris Manufacturing Company, 90 Second Street, San Francisco, Cal., has prepared a leaflet descriptive of its Wells motor-starting switches, designed for low-voltage and overload protection.

RECEPTACLES. — Pass & Seymour of Solvay, N. Y., have prepared three leaflets descriptive of their P. & S. 60,020 medium-base brass-covered receptacle, P. & S. 299 pull-chain brass splicing link, P. & S. porcelain receptacles and P. & S. sign receptacles.

CONVERSION TABLE. — The American Exporter Translation Bureau, 17 Battery Place, New York City, has prepared a set of conversion tables as follows: Avoirdupois pounds into kilograms, inches into centimeters, feet into meters, miles into kilometers, yards into meters, American gallons into liters, fractions of inches into millimeters, and metrical equivalent of wire gages.

AMMONIA FITTINGS AND ACCESSORIES.—The De La Vergne Machine Company of New York City has prepared a well-illustrated book descriptive of its ammonia fittings and accessories. Special attention is called to a section which comprises a comparison of various kinds of ammonia fittings, detailed instructions for making soldered joints and some very useful tables.

HEAT INSULATIONS. — The Magnesia Association of America, Philadelphia, Pa., is distributing its anniversary advertising portfolio entitled "85 Per Cent Magnesia," for 1917. It is pointed out that the importance of heat insulation in the conservation of the nation's fuel cannot be overrated. Because of the present scarcity and cost of coal this subject demands more careful consideration than ever before. The Magnesia Association of America was founded to give publicity to the supreme results in heat insulation achieved by "85 per cent magnesia." Accordingly, as a timely contribution to the public consideration of the most efficient form of heat insulation, the Magnesia Association presents this anniversary book of the first year of educational advertising—1917. The exact information given in these advertisements and the wide field of application which they cover are such as to render them of pertinent value and interest to all engineers and architects. The technical value of these advertisements rests primarily on the fact that all the technical statements therein are the result of more than twenty-five years of the most exhaustive engineering experience, and, secondly, on the fact that all the statements regarding the properties of "85 per cent magnesia" are corroborated by the specific indorsement of the Mellon Institute of the University of Pittsburgh.

ELECTRICAL EQUIPMENT IN THE WOODWORKING INDUSTRY. — This is the title of a new circular just issued by the Westinghouse Electric & Manufacturing Company. The publication is profusely illustrated by views of motor-driven woodworking machinery both alone and as installed in representative woodworking plants. Starting with the general subject of motor drive, the reasons for its adoption, such as increased production, better light, greater safety to employees, higher efficiency of machines, more accurate knowledge of cost and greater freedom in power distribution, are explained. The next section is devoted to features of Westinghouse motors which make them suitable for this work, such as rigid construction, sparkless commutation of direct-current machines, and simplicity and reliability of oiling. Assistance which may be rendered to owners of woodworking plants is described. This includes advice as to layout of plant and proper motors to use and prompt repair service in case of breakdown. The woodworking plant of Ferguson Brothers Company, Hoboken, N. J., is described and illustrated in a third section. It manufactures furniture and wooden novelties of various kinds and is completely equipped with motors. The rest of the book gives horsepower requirements and other data for many different sorts of woodworking machinery which will be of much value to those having to do with this class of industrial activity.

New Incorporations

THE DESHLER (NEB.) LIGHT & POWER COMPANY has been chartered with a capital stock of $100,000 by August F. Kollman and others.

THE MANCHESTER (WIS.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $3,000 by Gottlieb Pfeiffer and others.

THE WHY ELECTRIC COMPANY of Milwaukee, Wis., has been incorporated with a capital stock of $15,000 by Albert H. Walker, William F. Horn and Lafayette Yakes.

THE SERVICE ELECTRIC COMPANY of Goshen, Ind., has been incorporated by Herman A. Schmidt, Harvey Miller and George E. Rohrer. The company is capitalized at $8,000 and proposes to deal in electrical apparatus.

THE J. P. HAND COMPANY of Davenport, Iowa, has been chartered by J. P. Hand, Joseph Lewis and B. Simmon. The company is capitalized at $20,000 and proposes to manufacture automobile parts and storage batteries.

THE COLUMBIA BATTERY COMPANY of South Bend, Ind., has been incorporated with a capital stock of $10,000 by Otto M. Knoblock, Frank L. Stedman and William B. Starr. The company proposes to manufacture storage batteries.

THE DISPLAY STAGE LIGHTING COMPANY of New York, N. Y., has been incorporated with a capital stock of $10,000 by John Higham, Michael E. Kelly and William E. Price. The company will manufacture electrical stage apparatus.

THE DUBOIS (IDAHO) LIGHT & POWER COMPANY has been incorporated by C. N. Friday, J. M. Palmer and E. F. Palmer. The company is capitalized at $25,000 and proposes to supply electricity for lamps and motors in Dubois and vicinity.

THE NATIONAL ELECTRICAL APPLIANCE COMPANY has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $500,000. The incorporators are: C. L. Rimlinger, M. M. Clancy and F. A. Armstrong of Wilmington, Del.

THE OTISCO (N. Y.) LIGHT & POWER COMPANY has been incorporated by Earl T. Harter, Bessie L. Harter of Otisco and Maurice A. Phelps of Syracuse. The company is capitalized at $10,000 and proposes to generate and distribute electricity for lamps, heaters and motors.

THE CYNTHIANA (KY.) PLUMBING & ELECTRICAL COMPANY has been organized for the purpose of doing a general electrical business, wiring, dealing in electrical supplies and also a general plumbing, heating and gas-fitting business. J. F. Nooe is interested in the company.

THE RUBES ELECTRIC LAMP WORKS of Brooklyn, N. Y., have filed articles of incorporation with a capital stock of $10,000 for the purpose of manufacturing electric illuminating signals for trains. The incorporators are: Louis Rubes, Augusta Wegman and Nicholas Rubes of New York.

THE INTERCOUNTY ELECTRICAL COMPANY of Sidney, Ohio, has been incorporated with a capital stock of $100,000 by Edward W. Kelsey, Jr., Charles Weirich, R. O. Halloway, Randolph P. Whitehead and Webb O. Schwenk. The company proposes to take over the municipal electric plant in De Graff and Quincy.

THE C. RAZMERE ACCESSORIES has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $20,000 to deal in electrical supplies of all kinds. The incorporators are: Norman E. John, Edwin J. Hardcastle of Edgemore, Del.; David W. Masters and Catherine G. Masters of Wilmington, Del.

THE DUPLEXALITE CORPORATION of New York, N. Y., has been chartered with a capital stock of $275,000. The company proposes to manufacture gas and electric-light fixtures. The incorporators are: H. O. Walter, 60 Wall Street; L. C. Bunzl, 121 East Seventy-second Street, New York, N. Y., and L. Roche, Jersey City, N. J.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY of Chicago, Ill., has been incorporated with a capital stock of $3,000,000. The company is a consolidation of the Benjamin Electric Company of Chicago and the Royal Enameling & Manufacturing Company of Des Plaines, Ill. The manufacture of electrical specialties and lighting systems will be continued. The plant of the new company will eventually be located on a site of 82 acres in Des Plaines, formerly owned by the Royal Enameling & Manufacturing Company.

New England States

BATH, ME.—The Bath Water District has entered into a contract with the Central Maine Power Company of Augusta and the Bath & Brunswick Light & Power Company to supply electricity for operating the pumping system for a period of three years. This is the first step, it is said, toward equipping the entire system for electrical operation, and eventually to have a storage basin on this side of the Kennebec River, so as to do away entirely with the Nesquasset pumping station and the crossing of the river mains.

CLAREMONT, N. H.—Preparations are being made by the Claremont Power Company for the installation of the necessary equipment in its new substation.

BROOKFIELD, MASS.—The power station of the Worcester & Warren Street Railway Company was practically destroyed by fire on March 4, causing a loss of about $75,000. The road suspended service Jan. 16 and the power station has not been in use since Dec. 16.

SPRINGFIELD, MASS.—The Gilbert & Barker Manufacturing Company is erecting a large addition to its power house.

BRIDGEPORT, CONN.—Plans have been filed by the Fairbanks Storage Battery Company, 438 Atlantic Street, Stamford, for the construction of a new storage-battery station, 40 ft. by 120 ft., on Fairfield Avenue, Bridgeport. Contract for building has been awarded to W. A. Smith & Son, 188 Cannon Street, Bridgeport, at $20,000.

Middle Atlantic States

BROOKLYN, N. Y.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for alterations and improvements in the power plant at the Brooklyn Navy Yard to the Child & Scott Company, 112 Webster Street, New York City.

BUFFALO, N. Y.—A resolution has been introduced in the City Council by Commissioner Kreinheder providing for replacing all gas lamps in the city with electric lamps. There are now approximately 9000 gas lamps in use.

CHENANGO FORKS, N. Y.—Bids, it is understood, will soon be asked by the Binghamton Bridge Company, Press Building, Binghamton, for the construction of a power house at Chenango Forks. The equipment will include two 250-kw. water turbine-driven generators. A. L. Gilmore, Press Building, Binghamton, is engineer.

EAST AURORA, N. Y.—The plant and holdings of the East Aurora Electric Light Company are reported to have been purchased by Dr. George Stevenson, for $50,000. The new owner, it is understood, will make improvements to the service.

LONG ISLAND CITY, N. Y.—The New York & Queens County Railway Company, 444 Jackson Avenue, it is reported, is considering extension to its plant on property, recently acquired, consisting of nine and one-half acres at the intersection of the Long Island Railroad and Trotting Lane, Elmhurst.

NEW YORK, N. Y.—An amendment to the fire-alarm rules has been adopted by the Board of Standards and Appeals, permitting the installation of mechanical, non-coded closed circuit or coded closed-circuit fire-alarm signals in five-story factory buildings. The rule recently issued permitted these installations only in buildings up to four stories.

NEW YORK, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., for the construction of the United States assay office at New York City, the work to include deep foundations, safety vaults and certain mechanical equipment. Bids will also be received at the same time for the installation of one electric passenger elevator and three electric coin lifts in the United States assay office building, in accordance with drawings and specifications, copies of which may be obtained at the above office.

WAYNE, N. Y.—Three mills at the works of the Wayne Powder Company were recently destroyed by fire, including No. 1 and No. 2 wheel mills and the mixing mill, which was operated by electricity. The loss is estimated at about $100,000.

BORDENTOWN, N. J.—The Borough Council is considering plans for the installation of a new electric fire-alarm system.

EDGEWOOD, N. J.—Plans have been prepared by the United States government for the erection of a large plant for the manufacture of gas in Edgewood. The cost of the entire project is estimated at about $37,000,000.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

ELIZABETH, N. J.—Plans have been prepared for the erection of a four-story building, 60 ft. by 300 ft., with a wing to cover an area of 180 ft. by 300 ft., at 810-50 Frelinghuysen Avenue, for the Diehl Manufacturing Company, Trumbull Street.

GLOUCESTER, N. J.—Plans are being considered by the City Council for extensions and improvements to the electric street-lighting system.

HALEDON, N. J.—A movement has been inaugurated for the installation of an electric-light and power plant at the overflow of the borough reservoir at North Haledon. Adolph Branch and Charles Banta are reported to be interested in the project. Haledon has not a post office.

NEWARK, N. J.—The Hay Foundry & Iron Works is building an extension to its plant, and, it is understood, will soon require cranes and machinery for fabricating steel.

NEWARK, N. J.—The construction of a series of power houses between its different shipways, consisting of three plants, between ways Nos. 1 and 2, Nos. 3 and 4, Nos. 5 and 6, respectively, for the Submarine Boat Company, Port Newark, Newark, is under way. The company has nearly completed the erection of two steel fabricating shops.

TRENTON, N. J.—The City Commission has issued instructions to the Public Electric Service Company to keep the electric street-lighting service in operation during darkness only, in order to aid in the conservation of coal. It is also proposed to make extensions and improvements in the lighting system.

ALLENTOWN, PA.—Contract has been awarded to L. M. Kratz & Son, Allentown, by the City Council for alterations and improvements to the power house at the local pumping station, to cost about $15,000.

BELLEFONTE, PA.—Notice has been filed with the Public Service Commission by the State Centre (Pa.) Electric Company of an issue of $7,000 in bonds, the proceeds to be used for improvements, etc.

CHESTER, PA.—Contracts have been awarded by the Chester Shipbuilding Company for the construction of five buildings, including a punch and mold shop department, 190 ft. by 500 ft., to cost about $200,000; extensions to forge and blacksmith shop, $30,000; new ship carpenter shop, $30,000; general storehouse, $30,000, and tank building.

COUDERSPORT, PA.—Notice has been filed by the Home Electric Company with the Public Service Commission of an issue of $22,000 in bonds, the proceeds to be used for improvements to its plant and system.

ELLWOOD CITY, PA.—The Connoquenessing-Lawrence Light & Power Company, recently organized, proposes to supply electricity for lamps and motors in Ellwood City and adjacent territory. The company is capitalized at $10,000. The incorporators are: J. C. Chesnut, L. B. Round, H. N. Wood, M. Pendleton and C. H. Akens.

INDIAN CREEK, PA.—Plans have been prepared by King & Wightman, 1513 Walnut Street, Philadelphia, for the construction of a new power plant, 30 ft. by 70 ft., for the Mountain Water Supply Company, in Indian Creek.

LEMOYNE, PA.—Extensive improvements are being made to the local plant of the United Electric Company.

NEWPORT, PA.—The Juniata Public Service Company is erecting a new electric transmission line from Montgomery's Ferry to Liverpool, in connection with other improvements to its system.

WILLIAMSPORT, PA.—Plans have been prepared for the construction of a new power house near Rose Street and Erie Avenue for the Lycoming Rubber Company. The Lockwood Greene Company, 93 Federal Street, Mass., is engineer.

BALTIMORE, MD.—Contracts have been awarded by the Bartlett-Hayward Company, Scott and McHenry Streets, to Morrow Brothers, contractors, Fidelity Building, Baltimore, for the erection of a transformer house, about 28 ft. by 49 ft., at Columbia Avenue and Putnam Street; and for a heat-treating plant, 165 ft. by 62 ft., one story. Parker, Thomas & Rice, Union Trust Building, are architects.

ST. HELENA, MD.—Contracts have been awarded by the War Department, Washington, D. C., for construction of a plant at St. Helena for assembling and repairs of automobiles. A site on Colgate Creek of 100 acres has been acquired. The proposed plant will cost about $2,500,000, and will consist of about 50 steel and concrete buildings.

FAIRMONT, W. VA.—The Monongahela Valley Traction Company is planning to extend its car lines from Clarksburg to Salem, Philippi and Grafton; from Weston to Orlando and Fairmont to Morgantown. Work involving an expenditure of about $3,000,000 is contemplated this year by the company.

WHEELING, W. VA.—Plans are being prepared by the Wheeling Traction Company for the reconstruction of its Bay Island carhouse, recently destroyed by fire.

FRONT ROYAL, VA.—The Old Virginia Orchard Company is contemplating extensions to its plant, including the erection of a two-story building 30 ft. by 70 ft., installation of steam water pump, smokestack, electric elevator, and other machinery connected with the canning industry.

RICHMOND, VA.—Contract has been awarded by the War Department, Washington, D. C., to the George A. Fuller Company, Fuller Building, New York, N. Y., for the construction of the aviation concentration camp on Bellwood Farm, near Richmond, to cost between $3,000,000 and $4,000,000.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., has awarded contract for the construction of two temporary office buildings, one for the army and the other for the navy, to the Turner Construction Company of New York, N. Y. The buildings are to be erected on government property, between the Washington Monument and the Lincoln Memorial, south of B Street and west of Seventeenth Street. The cost is estimated at about $5,750,000.

North Central States

MUSKEGON, MICH.—The proposal to grant the Muskegon Traction & Lighting Company a 30-year franchise will be submitted to the voters at the April election.

AKRON, OHIO.—The Imperial Electric Company of Akron contemplates building an addition, 60 ft. by 100 ft., to its plant.

CINCINNATI, OHIO.—The Automatic Electrical Devices Company of Cincinnati has removed its offices from the Mercantile Library Building to 120 Opera Place, where its new shop will also be located. C. E. Ogden is president and general manager.

CINCINNATI, OHIO.—The Union Gas & Electric Company has petitioned the County Commissioners for permission to erect electric transmission lines along Anderson's Ferry Road, Cleves and Warsaw Pike, Lower River Road, Dugan Gap Road and Geist Road to the Ohio-Indiana state line to furnish electricity in Cleves, North Bend, Addyston and other villages below Cincinnati.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, Ohio, until March 15, for boiler ash hoppers for the division of light and heat. Specifications may be obtained at the office of the division of light and heat.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, Ohio, until March 19 for one two-ton auto truck for the Warrensville Infirmary, department of public welfare. Specifications may be obtained at the department of public welfare.

DEGRAFF, OHIO.—The Intercounty Electric Company, it is reported, has purchased the municipal electric-light plant in Degraff. Electricity to operate the local system will be secured from the Sidney Electric Company.

MARION, OHIO.—Contract, it is reported, has been placed by the Power Manufacturing Company of Marion for the erection of an addition, 82 ft. by 200 ft., one story high, to its plant.

OBERLIN, OHIO.—The high-tension line of the Lorain County Electric Company has been completed as far as Oberlin and is now supplying electricity to operate the local system. The plant of the Oberlin Gas & Electric Company, it is understood, will be closed down.

QUINCY, OHIO.—The municipal electric-light plant, it is reported, has been purchased by the Intercounty Electric Company. The local plant, it is understood, will be closed down, and electricity purchased from the Sidney Electric Company to operate the local system.

SIDNEY, OHIO.—The Intercounty Electric Company, recently incorporated with a capital stock of $100,000, has purchased the municipal electric-light plants in Quincy and Degraff. The company will transmit and distribute electricity in Quincy, Degraff and Pemberton and also to farmers along the route. Electricity to operate the system will be purchased from the Sidney Electric Company.

MIDDLESBORO, KY.—At a mass meeting held recently a committee was appointed to look into the matter of securing an electric street-railway service in Middlesboro. It is proposed to extend the car line to the mines to provide transportation to the laborers in that district. J. M. Rogan is chairman of the committee.

PADUCAH, KY.—W. A. Gardner, commissioner of public works, has petitioned the city commissioners for an appropriation of $40,000 for extension to the municipal electric-light plant, including the erection of an addition to the power house, installation of two 300-hp. boilers, and raising the roof of the plant.

ROXANA, KY.—The Estill Coal Company, it is understood, will install a plant to be equipped for electrical operation this spring. C. H. Trimble of Memphis, Tenn., is interested in the company.

ELWOOD, IND.—The capital stock of the Indiana General Service Company has been increased from $1,000,000 to $3,500,000.

MONGO, IND.—Owing to the dam being carried away by the flood the local electric-light and power plant has been put out of commission. It is proposed to purchase a gasoline engine to operate the plant until a new dam is built.

MUNCIE, IND.—The Public Service Commission has authorized the Muncie Electric Light Company to sell its plant and holdings to the Indiana Public Service Company of Aurora for $1,000,000.

CHICAGO, ILL.—The Public Service Company of Northern Illinois of Chicago has secured the consent of property owners on the "North Shore" of Chicago for a right-of-way for an extension of its electric transmission line between Evanston and Highland Park.

CHICAGO, ILL. — Contract has been awarded by the Inter Ocean Refining Company, 332 South Michigan Avenue, Chicago, Ill., for the construction of an oil refining plant and distributing station near Lyons consisting of a group of tanks, filter house, pump house, stills, boiler house, etc., to the Leonard Construction Company, 332 South Michigan Avenue.

GOOD HOPE, ILL.—The citizens of Good Hope have raised a subscription of $4,000 to finance a proposed electric-lighting system for the town.

BRODHEAD, WIS.—Plans are being considered for remodeling the municipal electric power station and lighting system. K. Guelson is superintendent.

CAMP DOUGLAS, WIS.—The Orange Light & Power Company expects to increase its hydraulic head and extend its transmission line to the village of Hustler. A. M. Patterson is manager.

MINERAL POINT, WIS.—The Mineral Point Public Service Company has recently completed a transmission line from Dodgeville to Ridgeway and a distribution system in Ridgeway. Energy is supplied to the village of Ridgeway near the city limits of Dolgeville. The erection of a 33,000-volt transmission line from Reway to Platteville is now under way. The new line will connect with the lines of the Interstate Light & Power Company of Galena, Ill., for an interchange of service in case of emergency. John C. Meiners of Milwaukee is president.

SUPERIOR, WIS.—Edward Kaner, who has recently purchased a site in Superior, it is reported, will erect buildings, to be equipped with electrically operated cranes and other machinery.

LANESBORO, MINN. — At an election held recently the proposal to issue $15,000 in bonds for the installation of an electric-lighting system was carried.

NASHWAUK, MINN.—Preparations are being made by the Water and Light Commission for extensive improvements to the municipal water and light plant. Since the power house was destroyed by fire the department has been handicapped in furnishing an adequate water supply. Orders have been placed for a new electrically driven well pump, to cost approximately $7,000.

ST. CLOUD, MINN.—Surveys are being made of the contour of the river bed at Pike Rapids, a power site owned by the Pike Rapids Power Company, north of St. Cloud, about 6 miles south of Little Falls.

WACONIA, MINN.—Bids will be received by Joseph Fuchs, clerk of Independent school district No. 44, until March 28, for the erection of a school building. Separate bids to be submitted on general construction work, heating and plumbing and electric work. Specifications may be seen at the office of Kirby T. Snyder, architect, Minneapolis, Minn., and at the Builders' Exchanges of Minneapolis and St. Paul, Minn.

EDDYVILLE, IOWA.—At an election to be held March 12 the proposal to issue $8,000 in bonds for improvements to the municipal electric-light plant will be submitted to the voters.

KANSAS CITY, MO.—The Kansas City Light & Power Company has filed an application with the Public Service Commission for permission to increase its capital stock from $4,977,300 to $10,000,000.

KANSAS CITY, MO.—Plans are being prepared for the construction of a pumping plant at East Bottoms, a duplicate of the Turkey Creek plant. At the election to be held April 22 the proposal to issue $1,250,000 for the proposed plant will be submitted to the voters. Burton Lowther is chief engineer.

ST. LOUIS, MO. — Contract has been awarded by the R. E. Burdeau Company, 2921 Locust Street, to the T. J. Ward Construction Company, 1519 Olive Street, St. Louis, for the erection of an automobile showroom, office and garage, 109 ft. by 125 ft., to cost about $50,000 without mechanical equipment. The plans provide for an electric freight elevator, electric-lighting and steam heat, etc.

NEW ENGLAND, N. D.—The Asby Light & Power Company is contemplating the purchase of a 75-hp. or 100-hp. oil engine; would prefer a good second-hand machine; also a three-phase generator and exciter to go with the generator. The company would like to communicate with dealers and manufacturers in regard to the above equipment. J. A. Meyer is secretary.

BROOKINGS, S. D.—Bids will be received by the Regents of Education of the State of South Dakota, addressed to the president of the State College of Agriculture and Mechanic Arts, Brookings, until March 15 (extension of date from Feb. 15), for the installation of electric wiring in an armory building to be erected at the State College of Agriculture and Mechanic Arts. Plans and specifications are on file in the office of F. H. Ellerbe, architect, St. Paul, Minn., and the secretary, Brookings, and the Builders' Exchanges of St. Paul and Minneapolis, Minn.

BROOKINGS, S. D.—Bids will be received by the Regents of the Board of Education of the State of South Dakota, addressed to secretary of the State College of Agriculture and Mechanic Arts, Brookings, until March 15, for the following work: For electrical wiring in armory building to be erected according to plans and specifications prepared by F. H. Ellerbe, architect, St. Paul, Minn.; for steam heating and electric wiring in addition to administration building, and for electric wiring in stock-judging pavilion, according to plans and specifications prepared by Joseph Schwarz, architect, Sioux Falls, S. D. Plans may be seen at the offices of the architects, Builders' Exchanges, at St. Paul and Minneapolis, and at the office of the secretary of the college, Brookings, I. D. Aldrich is secretary.

NEWARK, S. D.—The local electric-light plant, it is reported, has been purchased by Louis Severson. The new owner, it is understood, will install a new engine in the spring and increase the capacity of the plant.

SCOTLAND, S. D.—The Council has decided to submit the proposal to issue $35,000 in bonds for the installation of a municipal electric-light plant to the voters.

DAVIS CITY, NEB.—Bids, it is reported, are being taken by the Lincoln (Neb.) Telephone & Telegraph Company for the construction of a telephone exchange in Davis City.

FAIRBURY, NEB.—Plans are being prepared by the Lincoln (Neb.) Telephone & Telegraph Company for the construction of a telephone exchange in Fairbury, to cost about $12,000.

JUNIATA, NEB.—At an election held recently bonds to the amount of $6,800 were authorized for the installation of an electric-lighting system. The project includes the erection of an electric transmission line to Hastings.

LINCOLN, NEB.—The Lincoln Telephone & Telegraph Company has petitioned the Nebraska Railroad Commission for permission to increase its capital by $50 000, the proceeds to be used for extensions to lines.

SIDNEY, NEB.—Bids will be received by the city clerk, Sidney, until March 12, it is reported, for machinery for the municipal electric-light plant and waterworks system as follows: One 250-hp. steam engine, two 200-hp. boilers, one alternating-current generator for direct connection to engine, one steel smokestack, switchboard and instruments, feed-water pumps, and feed-water heater, auto-stokers, coal-handling machinery and enlarging coal bins, etc. Alternate bids will also be received on two 150-hp. internal-combustion oil engines, 10,000-gal. fuel-oil tank.

ATCHISON, KAN.—Contract has been awarded by the Blair Milling Company to the Missouri Valley Bridge & Iron Works of Leavenworth for the construction of a power house, 86 ft. by 102 ft., to cost about $40,000.

DIGHTON, KAN.—Another election, it is understood, will be called to vote on the proposal to issue bonds for extensions to the municipal electric-light plant and water-works system. The amount ($10,000) which was at first decided upon will not be sufficient to carry out the proposed plans.

EUREKA, KAN.—Bids will be received by J. W. Kenner, clerk, Eureka, until March 15 (extension of date from Feb. 27) for two 400-gal-per-minute vertical centrifugal pumps and motors, pumping against a total head of 40 ft.; two 10-ft. by 10-in. gravity mechanical filters and all mechanical filters and necessary equipment; construction of coagulating basins, filter house and clear well. Black & Veatch, Inter-State Building, Kansas City, Mo., are engineers.

HUNTER, KAN.—The installation of an ornamental street-lighting system in Hunter is reported to be under consideration.

LAWRENCE, KAN.—Bids will be received by the Board of Administration, Topeka, Kan., until March 14 for the Administration and Liberal Arts Building at the University of Kansas, Lawrence, including plumbing, electric wiring and steam heating. The cost of the building is estimated at about $225,000. R. L. Gamble of Topeka is architect.

WICHITA, KAN. — The Public Utilities Commission has granted the Wichita Walnut Valley Interurban Railway Company permission to issue $1,000,000 in bonds and $200,000 in capital stock, the proceeds to be used to acquire real estate for rights-of-way, terminal and station purposes and to construct and operate that portion of the line which connects Wichita, El Dorado and Augusta, about 40 miles long. Charles E. Payne is secretary.

Southern States

RALEIGH, N. C.—Bids will be received until March 14 for the installation of an elevator for building to be erected at the State Hospital for Insane. Drawings and specifications may be obtained from Harry Barton, architect, Greensboro. Albert Anderson, Dix Hill, Raleigh, is superintendent.

GREENWOOD, S. C.—Plans are being considered by the owners of the Panola Mill for the installation of street lamps and also for lighting residences.

ATLANTA, GA.—At an election to be held March 25 the proposal to issue $75,000 in bonds for the installation of an electric generating plant will be submitted to the voters.

SANDERSVILLE, GA.—The City Council is planning to rebuild the municipal electric-light and water plant, recently damaged by fire, causing a loss of about $10,000.

CHRISTINA, FLA.—The Phosphate Mining Company, it is reported, is planning to rebuild its electric power plant, recently destroyed by fire. P. H. Fuller of Nichols, Fla., is general manager.

DAYTONA, FLA.—The capital stock of the Daytona Public Company has been increased from $300,000 to $500,000.

MIAMI, FLA.—The City Council has decided to install arc lamps on Biscayne Drive and Avenue B from Twelfth Street to Buena Vista.

NASHVILLE, TENN. — The Nashville Railway & Light Company will soon begin surveys for an extension of its Gallatin turnpike line to near Hadleys Bend, and also for an extension of the Fairfield line along the Lebanon Road.

SEVIERVILLE, TENN.—The Tennessee Manganese Company is contemplating the installation of a steel furnace (25 tons daily capacity) to convert ore into ferro-manganese at Sevierville. D. C. Campbell of Knoxville is president.

MOBILE, ALA. — The Tennessee Coal, Iron & Railroad Company, it is reported, will construct an electric railway (1½ miles long) to connect with the tracks of the Mobile Light & Railroad Company, to pro-

vide street-car service to the new Chickasaw Shipbuilding plant. George Gordon Crawford of Birmingham is president.

MOBILE, ALA. — The Mobile & Ohio Railroad Company has awarded contract for the construction of conveyor for grain elevator to Hancock, Harbin & Hancock of Mobile, at $15,000. The elevator will be equipped with electrically operated machinery and will have a capacity of 250,000 bushels. The elevator machinery will be installed under the direction of the R. C. Stone Engineering Company, Merchants' Exchange Building, St. Louis, Mo.

CORINTH, MISS. — The Supervisors of Alcorn County have awarded contract to B. G. Parish, Jackson, Tenn., for the construction of court house, to cost about $90,000, without mechanical equipment.

CRYSTAL SPRINGS, MISS.—Arrangements have been completed by W. B. Lockwood, representing the town of Crystal Springs, for borrowing $5,000, authorized by the Legislature for the purpose of installing new equipment in the municipal electric-light plant. The installation of the machinery, it is expected, will soon be completed.

HELENA, ARK.—The capital stock of the Helena Gas & Electric Company has been increased from $300,000 to $500,000. The company, it is said, contemplates extensions to its plant and the installation of new equipment.

ROGERS, ARK.—The City Council has adopted a resolution favoring the purchase of the electric plant of the Rogers Light & Power Company to be owned and operated by the municipality.

NEW ORLEANS, LA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 25 for a 10-ton electric traveling bridge crane, installed on existing runways in the storage shed at the naval station at New Orleans. Specifications No. 2839 may be obtained on application to the above bureau or to the commandant of the naval station named.

ADA, OKLA.—The Oklahoma Power & Transmission Company, it is reported, contemplates the erection of transmission lines to furnish electricity to all the towns in the surrounding territory.

AFTON, OKLA.—The City Council is considering the question of selling the municipal electric-lighting plant. Owing to high price of coal and the present charge for service the plant is not self-supporting.

BRISTOW, OKLA.—At an election to be held on March 12 the proposal to issue $36,000 in bonds, the proceeds to be used for the purchase and improvement of the local electric-light plant, will be submitted to the voters.

COLLINSVILLE, OKLA.—The construction of an electric interurban railway from Collinsville to Nowata, Okla., Coffeyville, Kan., and other points is under consideration. D. H. Siggins of Coffeyville, Kan., is reported interested in the project.

HENRYETTA, OKLA. — The Henryetta Ice & Cold Storage Company is installing an ornamental street-lighting system, consisting of 42 standards. J. E. Meaders is purchasing agent.

HOMINY, OKLA. — The Hominy Ice, Light & Power Company has purchased an additional electric generating unit, consisting of a 150-hp. gas engine "Westinghouse," directly connected to a 100-kw. three-phase, 60-cycle, 2300-volt generator, to be delivered about April 1. G. J. Smallwood is secretary.

McALESTER, OKLA. — The Missouri, Kansas & Texas Railway Company is planning to install a 300-ton mechanical coal chute at McAlester. F. Ringer of Dallas is chief engineer.

PRAGUE, OKLA.—The City Council has decided to call an election to submit the proposal to issue $45,000 in bonds for improvements to the municipal electric-light plant and water-works system to the voters.

AUSTIN, TEX.—Plans are being prepared for the erection of a new telephone exchange building for the local telephone company.

GRANBURY, TEX.—The Granbury Cotton Oil Company, it is reported, is contemplating the purchase of a new or second-hand 150-hp. crude-oil engine, either directly connected or belted to generator; also a 250-hp. to 300-hp. crude-oil engine, either belted or direct-connected type.

LOMETA, TEX.—F. C. Whittmire, it is reported, is planning to rebuild the local electric-light plant, recently destroyed by fire, causing a loss of about $5,000.

McKINNEY, TEX.—The local electric plant of the Texas Light & Power Company was partially destroyed by fire recently, causing a loss of about $8,000.

Pacific and Mountain States

CHEHALIS, WASH.—The Central Light & Manufacturing Company of Chehalis has filed a petition with the Commissioners of Lewis County asking for a franchise to construct and operate an electric transmission line from Walville at the Lewis-Pacific county line to Meskill, 12 miles west of Chehalis. If the franchise is granted, it is understood that the western Lewis County towns will be supplied with electricity from the transmission lines of the North Coast Power Company operating in this section.

TACOMA, WASH.—At the municipal election to be held April 2 the proposal to issue $6,500,000 in bonds for the acquisition by condemnation or stipulation of the entire street railway system of the Tacoma Railway & Power Company will be submitted to the voters.

TACOMA, WASH.—A permit has been granted for the installation of underground conduits from the Nisqually substation at Twenty-third and C Streets to Winthrop Avenue. The new circuits (which will be the first underground conduits in Tacoma) will supply energy for the shipyards and the tideflats.

GARDINER, ORE.—Steps have been taken by Warren Reed of Gardiner and James R. Wheeler and Arthur Blanchard of Marshfield to organize a new electric company to be known as the Umpqua Power Company. The new company will take over the property of the Gardiner Light & Power Company and will furnish electrical service in this city and Reedsport, now without service.

FRESNO, CAL.—The Copper Mine substation of the San Joaquin Light & Power Company was recently destroyed by fire, causing a loss of about $3,000.

REDDING, CAL.—At the annual election to be held April 8 the proposal to issue $40,000 in bonds to build or acquire a municipal electric-light plant will be submitted to the voters.

BOISE, IDAHO. — The City Council is considering the installation of a new street-lighting system.

BOWIE, ARIZ. — The Southern Pacific Company has appropriated $20,000 for remodeling its depot in Bowie and is also contemplating the installation of a power plant here.

BILLINGS, MONT. — The City Council has authorized the city clerk to call for bids for installing street lamps in special lighting district No. 3.

GREAT FALLS, MONT. — Work will start immediately by the Anaconda Copper Mining Company on the construction of a plant at the Boston & Montana Works at Great Falls for the electrolytic production of ferro-manganese. Five furnaces will be installed each with a daily capacity of 250 tons. Electric power will be supplied by the Montana Power Company.

DEMING, N. M. — Extensions and improvements involving an expenditure of at least $300,000 will be made at Camp Cody, Deming. The proposed work will include another electric power plant of 185 hp., new headquarters building for nurses, new headquarters building for officers, operating pavilion, new hospital for treatment of eye, ear, nose and throat affections, new barracks, an inclined railway, another 100,000-gal. tank, etc.

Canada

FORT SASKATCHEWAN, ALTA. — Orders have been placed for equipment for the municipal electric-light plant, including one 125-hp. open-feed water heater, one steam main, consisting of 3-in. pipe, two non-return valves pipe bends and flangers. One boiler-tube rattler, one Lennox drive and one small motor-driven centrifugal vertical pump may possibly be purchased. E. Barnott is general superintendent.

NELSON, B. C.—Preliminary plans are being prepared by the Consolidated Mining & Smelting Company of Trail, B. C., for the construction of a concentrator plant in Nelson.

WOODSTOCK, N. B. — The Woodstock Electric Railway, Light & Power Company is contemplating improvements to its plant this summer, including the installation of a Hercules turbine type D of the Holyoke Manufacturing Company, developing 137½ hp. at 13 ft. head, belt-connected to a Westinghouse generator in synchronism with two other generators. A. Gordon Bailey is secretary and treasurer.

DARTMOUTH, N. S.—Tenders will soon be asked for electrical work for the new plant of the Canadian Carbonate Company, 132 Hollis Street, Halifax.

HALIFAX, N. S.—Tenders are being received by Bate, McMahon & Company, Sparks Street, Ottawa, and Halifax Hotel, Halifax, for electrical work for the military huts for the Department of Public Works, Dominion Government.

SHELBURNE, N. S.—Frank J. Carter of Dartmouth, it is reported, is planning to erect and operate a cold-storage warehouse at Shelburne, to cost not less than $40,000.

HAMILTON, ONT.—The rebuilding of the Central Market and the installation of a new refrigerating system, to cost about $100,000, is under consideration by the City Council. E. R. Gray is city engineer.

LONDON, ONT. — The Public Utilities Commission is considering the purchase of two electrically-driven pumps, with a capacity of 600 gal. per minute, for the water works system. Philip Pocock is chairman.

LYNDHURST, ONT.—Improvements are contemplated to the local electric-light plant, owned by George E. Roddick, this coming summer, including the installation of 200-hp. waterwheels for the purpose of supplying electricity for lamps and motors to farmers and residents in the vicinity of Lyndhurst. It is also proposed to erect electric transmission lines (4 miles) through Oak Leaf and to connect up Suleys Bay.

SMITH'S FALLS, ONT.—The city of Smith's Falls has taken over the properties of the Citizens' Gas & Electric Company and the Smith's Falls Electric Power Company. Although the two plants are operating separately as yet, the intention is to reconstruct and unify the local distribution systems as speedily as possible and to operate them in parallel with the supply obtained from Merrickville through the transmission line of the Hydro-Electric Power Commission of Ontario. H. F. Shearer is manager.

STOUFFVILLE, ONT.—Plans are being considered to change the municipal electric-light plant from steam power to producer-gas fuel. R. O. Ward is superintendent.

TORONTO, ONT.—A permit has been granted to the Dominion Shipbuilding Company to erect a workshop and general machine plant at the foot of Bathurst Street, to cost about $175,000.

UXBRIDGE, ONT. — Arrangements are being made by J. W. Gould, owner of the local electric-light plant, for the installation of a 70-kva. Bullock three-phase, 2300-volt generator this spring. Equipment has already been purchased.

WATERLOO, ONT.—The Waterloo Water and Light Commission is contemplating the installation of a regulator. C. W. Schiedle is secretary and manager.

ST. NARCISSE, QUE.—The North Shore Power Company, Power Building, Three Rivers, it is reported, will build a dam, to cost about $15,000, at St. Narcisse.

SHERBROOKE, QUE.—The city of Sherbrooke is now installing in the Weedon plant (30 miles from Sherbrooke) a 1300-kva. generator and a 2000-kva. three-phase 2400/50,000-volt transformer, and is also building a general distributing station in Sherbrooke to receive power from all generating stations. Charles Desbaillets is manager and engineer.

MOOSE JAW, SASK.—Improvements are contemplated to the municipal electric-light plant this year, including the installation of an ash-handling plant, circulating pump and vacuum pump, steam-flow meters, CO_2 recorders, etc. J. D. Peters is manager.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until March 23 for generator sets, switchboards, copper cable, end bells, transformers, connectors, terminals, receptacles, copper rod, busbar supports, pipe fittings and floor flanges. Blanks and information pertaining to this circular (No. 1203) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until March 27 for steel, iron or steel pipe, steel and copper cable, duplex and ignition cable, bronze copper, phosphor tin, motor-generator sets, transformers, starting compensator, end bells, busbar supports, electrical switches, split-T connectors, cable clips, speaking-tube mouthpieces, etc. Blanks and information relating to this circular (No. 1205) may be obtained at the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y., 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

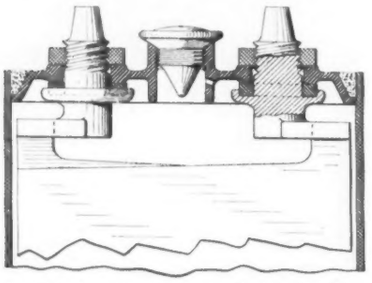
(Issued Feb. 5, 1918.)

1,255,597. INDUSTRIAL ELECTRICAL CAPACITY BATTERY; George Giles, Friburg, Switzerland. App. filed Oct. 16, 1916. Improvements.

1,255,598. SWITCH MACHINE; Gardner B. Gray, Pittsburgh, Pa. App. filed Feb. 5, 1916. Composed of two units.

1,255,607. DYNAMO-ELECTRIC MACHINE; William T. Hensley, Connersville, Ind. App. filed June 8, 1912. Involving the use of sheet metal in the manufacture of generators and motors.

1,255,613. ELECTRIC FURNACE-CONTROL APPARATUS; Alvin D. Keene, Schenectady, N. Y. App. filed Sept. 5, 1917. Electrodes may be automatically moved into contact with a stationary conductor at the beginning of the furnace operation to strike the arcs.



1,256,006—Secondary or Storage Battery

1,255,637. ADJUSTABLE SPARK GAP; Albert E. Reade, Petersburg, Va. App. filed June 8, 1916. Mounted upon the outer end of a spark plug so that the spark plate, being carried upon the insulating strip, may be held in an adjusted position.

1,255,639. CHANDELIER CLUSTER HOOK; Alfred W. Reiser, Toledo, Ohio. App. filed July 27, 1917. Will greatly facilitate the installation of fixtures.

1,255,646. MAGNETIC AERIAL APPARATUS; Patrick J. Ruddy, Centralia, Pa. App. filed Feb. 24, 1916. Aerial telephone in which magnets are utilized to cause high oscillating currents and reproduce and magnify similar vibrations in the air and earth so that sounds may be received and sent.

1,255,651. COUPLER FOR MUSICAL INSTRUMENTS; Melvin L. Severy, Arlington Heights, Mass. App. filed March 31, 1913. Improvements.

1,255,667. HIGH-POTENTIAL INSULATOR; Elihu Thomson, Swampscott, Mass. App. filed Jan. 9, 1913. Utilizing the principle of the non-conducting and insulating character of a very high vacuum.

1,255,681. COMMUTATOR; Charles C. Zenk, Wilkinsburg, Pa., App. filed July 8, 1912. Improvements.

1,255,712. ARMATURE-WINDING MACHINE; Newton Crane, Boston, Mass. App. filed June 3, 1914. Improvements.

1,255,713. ELECTRIC REGULATOR; John L. Creveling, New York, N. Y. App. filed March 16, 1910. Improvements.

1,255,721. SYNCHRONOUS ELECTRIC MOTOR; James K. Elderkin, Jr., Newark, N. J. App. filed Feb. 17, 1916. Improvements.

1,255,724. AUTOMOBILE; Roland S. Fend, Chicago, Ill. App. filed May 5, 1915. In which an internal-combustion engine and an electric motor and storage battery cooperate to form the prime mover for the vehicle.

1,255,771. ELECTRIC WAFFLE STOVE; Joseva Miller, Pasadena, Cal. App. filed Nov. 8, 1915. Improvements.

1,255,774. SWIVEL CONNECTION; Lembert H. Moulthrop, Philadelphia, Pa. App. filed Dec. 8, 1915. May be adjusted either to connect such parts movably so as to permit their relative rotation or to clamp them immovably together.

1,255,795. IGNITION TIMER; Ralph V. Savager, Sedalia, Mo. App. filed July 5, 1917. For regulating the time of the operation of the sparking plug.

1,255,814. ELECTRIC HEATER; Edmund N. Brown, San Francisco, Cal. App. filed Dec. 26, 1917. Improvements.

1,255,824. INSULATED TESTING-PLUG TERMINAL; San Francisco, Cal. App. filed Aug. 13, 1917. Adapted to be attached to the conducting cords connected to indicating or testing instruments.

1,255,838. DYNAMO-ELECTRIC MACHINERY; Rudolf Knoll, Enner-Baden, Switzerland. App. filed March 20, 1916. Relates to unipolar or homopolar dynamo-electric machines.

Record of Electrical Patents

Notes on United States Patents

1,255,840. ELECTRIC RADIATOR; Richard G. Ledig, Philadelphia, Pa. App. filed Aug. 7, 1917. Heat waves generated by a resistance coil are directed by means of polished metal reflector.

(Issued Feb. 12, 1918.)

1,255,846. CIRCUIT-MAKE-AND-BREAK DEVICE; Walter D. Appel, Cleveland Heights Village, Ohio. App. filed Feb. 11, 1916. In connection with the electric ignition circuits of internal-combustion engines.

1,255,853. MEANS FOR LOCATING FAULTS ON ALTERNATING-CURRENT CIRCUITS; Karl H. Bausman, Dayton, Ohio. App. filed Feb. 7, 1917. Exploring coils.

1,255,861. DAMPING MATERIALS FOR TELEPHONES; Irving B. Crandall, New York, N. Y. App. filed Aug. 14, 1916. Of vibrating members.

1,255,863. OUTLET BOX OR FIXTURE; Lionel W. Compton and Earle N. Oliver, Tampa, Fla. App. filed May 1, 1915. For facilitating the connection and support of electric conductors or for supporting a chandelier or the like.

1,255,866. SIGNAL SYSTEM FOR ELEVATORS; Edward L. Dunn, Worcester, Mass. App. filed Nov. 13, 1913. For use in department stores.

1,255,874. MOTOR-CONTROL SYSTEM; Maurice M. Goldenstein, Milwaukee, Wis. App. filed Feb. 26, 1917. Relates to multi-unit printing presses and similar mechanisms.

1,255,887. ELECTRIC SWITCH; Charles J. Klein, Milwaukee, Wis. App. filed June 3, 1911. Multi-circuit.

1,255,895. ELECTRIC VIBRATOR MASSAGE MACHINE; William J. A. Kuehl, Chicago, Ill. App. filed March 2, 1917. Improvements.

1,255,905. ELECTRIC CLOCK; Edwin H. Messiter, Brooklyn, N. Y. App. filed Dec. 5, 1914. Avoids the use of weights, springs and complicated gearing and operates with very small friction losses and wear.

1,255,943. ELECTRICAL CONNECTOR; Parke T. Snyder, Chicago, Ill. App. filed Aug. 14, 1916. Socket for receiving either a single or double contact Edi-Swan plug or lamp base.

1,255,947. TRANSFORMER AND LIKE COILS; Chester H. Thordarson, Chicago, Ill. App. filed Dec. 8, 1913. Provides means for maintaining the elements of the coil structure in proper position with relation to each other and to the insulation interposed between the elements.

1,255,948. COIL STRUCTURE FOR TRANSFORMERS AND THE LIKE; Chester H. Thordarson, Chicago, Ill. App. filed July 10, 1915. Novel winding-coil structure of the pancake or disk type.

1,255,959. SIGNAL; Frank T. Vanatta, Mill Valley, Cal. App. filed March 15, 1916. For use at grade crossings of railways.

1,255,964. TELEPHONE-EXCHANGE SYSTEM; Harry G. Webster, Chicago, Ill. App. filed May 20, 1914. Applied particularly to such apparatus in connection with instruction circuits of telephone-exchange systems.

1,255,968. TIME CONTROLLING AND RECORDING MECHANISM; Walter Williamson, Everett, Mass. App. filed April 2, 1915. Particularly for use with a steam-whistle valve.

1,255,998. WINDMILL GENERATOR SET; Fred J. Fahle, Luckey, Ohio. App. filed July 22, 1915. The wheel of the mill moves at substantially a constant speed when the circuit of the generator is completed.

1,256,003. SANITARY ATTACHMENT FOR TELEPHONE TRANSMITTERS; Maries S. Federman, New York, N. Y. App. filed Feb. 19, 1917. Pad treated with an antiseptic solution.

1,256,006. SECONDARY OR STORAGE BATTERY; Bruce Ford, Philadelphia, Pa. App. filed Dec. 22, 1916. Retaining the gasket employed to seal the terminal post to cell cover.

1,256,043. RENEWABLE CARTRIDGE FUSE; Emerich Sabina and Lester I. Cope, Sharpsburg, Pa. App. filed Oct. 29, 1915. Can be renewed without the use of tools.

1,256,063. ALTERNATING-CURRENT RECTIFIER; Howard A. Selah, Newark, N. J. App. filed March 29, 1915. Improvements.

1,256,066. FUSIBLE SERVICE PROTECTOR; Christopher H. Shoebridge, New York, N. Y. App. filed Dec. 15, 1915. Improvements.

1,256,067. ELECTROLYTIC APPARATUS; Harry T. Shriver, West Orange, N. J. App. filed Jan. 20, 1916. Improvements.

1,256,087. TELEPHONE-EXCHANGE SYSTEM; Samuel B. Williams, Jr., and Edgar H. Clark, New York, N. Y. App. filed March 21, 1917. Improved organization for automatically controlling the distribution of calls in a telephone-call distributing system.

1,256,098. SIGNALING DEVICE; Berthold A. Baer, Philadelphia, Pa. App. filed April 6, 1915. For use with moving vehicle.

1,256,123. TELEPHONE APPARATUS; Geroeg I. Galitzka, New York, N. Y. App. filed March 14, 1917. Adapted to notify and warn the subscriber that the local switchboard operator's set is connected in the line and the local operator is therefore able to listen in.

1,256,125. MASTER CONTROL AND LOCK FOR ELECTRIC CIRCUITS IN AUTOMOBILES; Leon Goldmerstein, New York, N. Y. App. filed Dec. 4, 1915. Improvements.

1,256,126. AUTOMATIC TELEPHONE-EXCHANGE SYSTEM; Charles L. Goodrum, New York, N. Y. App. filed May 25, 1916. Means for segregating a desired class of calls.

1,256,134. AUTOMATIC SIGNALING DEVICE; Thomas D. Joeck, Asbury Park, N. J. App. filed Nov. 7, 1916. For automobile or other vehicle.

1,256,170. ELECTRICITY METERING; Edmund O. Schweitzer, Chicago, Ill. App. filed Dec. 31, 1915. Improved means for accurately metering the consumption of electricity, and more particularly means for affording a satisfactory basis for payment to the central-station company by the consumer for electrical energy furnished to and consumed by him.

1,256,195. ELECTRIC SWITCH; Winfield A. Atwood, Schenectady, N. Y. App. filed March 13, 1917. Magnetic blow-out type.

1,256,207. ELECTRICAL SYSTEM OF DISTRIBUTION; Gorham Crosby, Glen Ridge, N. J. App. filed Feb. 25, 1916. Adapted to a storage battery, and automatic means are provided for regulating the voltage to the generator.

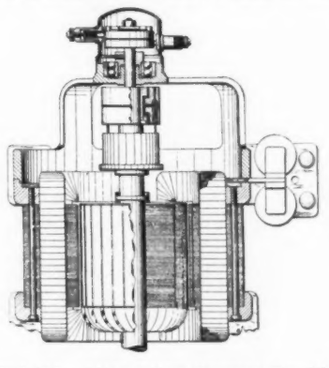
1,256,210. ELECTRIC SWITCH; William W. Dean, Chicago, Ill. App. filed June 7, 1913. Improvements.

1,256,212. DYNAMO-ELECTRIC MACHINE; John V. Dobson, Wilkinsburg, Pa. App. filed July 22, 1915. Railway.

1,256,223. ELECTRICAL SYSTEM; Hugo Grob, Zurich, Switzerland. App. filed Jan. 30, 1911. Electric lighting of railway trains or other vehicles.

1,256,228. APPARATUS FOR CHARGING STORAGE BATTERIES; William T. Hensley, Bound Brook, N. J. App. filed Nov. 9, 1914. Improvements.

1,256,234. MECHANISM FOR INTEGRATING POWER-CURRENT VALUES; Frank B. Innes, Detroit, Mich. Volt-ampere-hour units may be registered directly and accurately without the necessity of taking cognizance of the angular separation of pressure and current.



1,256,063—Alternating-Current Rectifier

1,256,258. POLARITY INDICATOR; Emil R. Richter, Chicago, Ill. App. filed Jan. 23, 1917. For battery circuits.

1,256,262. ELECTRIC SIGNAL DEVICE; John Roeder, Chicago, Ill. App. filed Nov. 6, 1914. Visual signal in the form of an electric lamp.

1,256,270. QUENCH-SPARK GAP; George Seibt, Schöneberg, Berlin, Germany. App. filed Dec. 1, 1911. Employed in connection with the oscillating systems of wireless-telegraph apparatus.